NEWSLETTER

Army-Marine Integration Vol. II

Observations, Insights, and Lessons

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Foreword

This newsletter emphasizes Army and Marine Corps efforts as joint or coalition forces. These professional journal articles focus on joint teams integrating logistics support to the warfighter. Topics include supply operations for Operations Iraqi Freedom and Enduring Freedom, resupply and retail assistance for strategic sustainment missions, research and development of logistic systems with interoperability, fielding products, and understanding joint asset visibility. Maintaining unit supply support and individual core supply skills are crucial while operating in tactical hybrid conditions. Implementing this capability during multi-functional support roles is imperative for adapting supply support that is both responsive and flexible. Soldiers and Marines evolve into hybrid forces capable of meeting joint warfighter logistical requirements at the tactical and operational echelons.

CALL and MCCLL hope this issue stimulates innovation and sharing of ideas between services. Implementing lessons learned and best practices today and in the future will ensure our forces organize and operate more effectively.
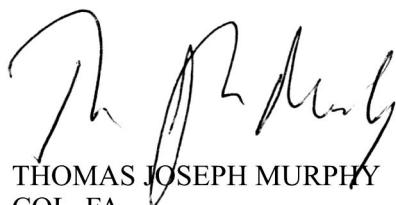
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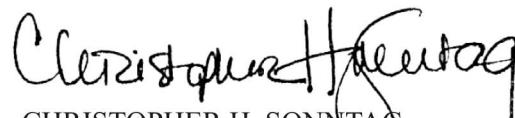
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The intent of this CALL publication is to share knowledge, support discussion, and impart lessons and information in an expeditious manner. This CALL publication is not a doctrinal product. The observations, insights and lessons (OIL) observed and reported in this publication are written mostly by Soldiers and Marines for use by service members and DOD agencies.

Please send relevant articles on Army-Marine Corps integration efforts for TTP, best practices, or research and development to the CALL LNO by mail: CG, TECOM (MCCLL), ATTN: CALL LNO, 1019 Elliot Road, Quantico, VA 22134; or by email: *mccll_ops@usmc.mil.*

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MCCLL relies on individual Marines, commands, and sponsors numerous collections teams addressing specific topics relevant to ongoing combat and contemporary operations, exercises, and training evolutions for their hard-learned lessons and observations. The goal is getting MCCLL publications of these knowledge jewels to the next Marine in the deployment queue and throughout the Marine Corps. Lesson learned publications are primarily stored digitally in the MCCLL Lesson Management Center (LMC) and Consolidated Document Repository (CDR). Most publications are highlighted in the MCCLL monthly newsletter. Publications are hosted on the MCCLL NIPR and SIPR websites. Immediate access is provided by use of a Common Access Card (CAC).

The Secretary of the Army has determined that the publication of this periodical is necessary in the transaction of the public business as required by law of the Department.

Unless otherwise stated, whenever the masculine or feminine gender is used, both are intended.

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Introduction

The following collection of articles is primarily focused on the sustainment of the Army and Marine Corps during tactical and strategic missions as joint or coalition forces. This newsletter discusses integrating joint team efforts in support of the warfighter. These articles include tactical hybrid conditions in Operations Iraqi Freedom and Enduring Freedom, strategic sustainment missions for war reserves/preposition supplies, research, product development, and joint asset visibility. Issues address command and control, communications, ground lines of communication, non-doctrinal missions, training, equipment, system interoperability, and lessons learned. This diverse mix is not all-inclusive. Articles pertain to the current logistics systems or operational employments used by the Army and Marine Corps. This effort captures relevant lessons and observations published in professional journals to inform Soldiers, Marines, and Department of Defense (DOD) users in developing best practices. Most articles were written by subject-matter experts and/or the service member in theater, thus reflecting accurate lessons learned through real-world experience.

Because logistical support teams have garnered much attention in the past, this newsletter attempts to document challenges and efforts in synchronizing the transformation to the asynchronous battlefield. These teams' innovative solutions and perspectives help design adaptive logistics support providing flexible sustainment. Meeting joint warfighter requirements at the tactical and operational echelons is crucial. Logistics systems must serve warfighter demands as an enabler, not as disabler. In many instances, the ideas presented in these articles are personal opinion and may not reflect approved doctrine. The recommendations in these articles should always be validated with the latest approved designs and the most current Army, Marine Corps, and/or joint doctrine.

CALL acknowledges and thanks the professional journals and authors who permitted the reproduction of these articles.

CALL editors note: Minor modifications to format were made by CALL editors to support the CALL newsletter format. Pictures not referenced in the narrative were deleted to save space.

Chapter 1: Tactical Logistics Supporting the Warfighter for OIF

Section 1:
Quartermaster Commentary: Joint and Expeditionary Fuel Logistics in Northern Iraq

CPT Jamie L. Krump

Reprinted with permission from the Winter 2004 issue of *Quartermaster Professional Bulletin.*

Today's Army is revamping to meet the design of a Joint and Expeditionary Force, a lighter force that is more quickly deployable. Within the next few years, Army Transformation will yield a force that can be tailored to combat any enemy force worldwide. The effectiveness of this revolutionary concept was displayed, and its fundamentals reinforced, when the 173d Airborne Brigade, Southern European Task Force (SETAF), and Task Force 1-63 Heavy Reaction Company (HRC) and Medium Reaction Company (MRC) from the 1st Infantry Division deployed completely by air into northern Iraq in Spring 2003 for Operation Iraqi Freedom. This successful deployment supported the concept of "joint and expeditionary" before this was commonplace. This deployment confirmed the ability to deploy and sustain both light and heavy assets in an austere, isolated environment for an extended time.

In March 2003, the Turkish Parliament voted to deny the use of Turkey's borders to United States troops to provide a northern axis for the march toward Baghdad, Iraq. This denied the passage of the 4th Infantry Division into northern Iraq via Turkey and forced the United States to develop an alternate plan to place significant combat forces in the north. The solution was to air drop the 173d Airborne Brigade just 30 miles south of the Turkish border. Fifteen C-17 aircraft dropped 1,000 paratroopers and their equipment 26 Mar 03 near Bashur Airfield, Iraq, as a show of force in order to stabilize the region and deny the option of northern routes for retreat by Saddam Hussein's regime. In the next 96 hours, 48 C-17s air-landed 2,200 troops and 400 pieces of rolling stock at Bashur Kirkuk Airfield to complete the 173d insertion. The 100 percent aerial deployment of this brigade was complete on 30 Mar 03. Within days, conditions were ready for Task Force 1-63 HRC and MRC to land at the airfield.

In itself, this mission was a first because a light airborne brigade augmented with heavy mechanized assets was inserted by air into northern Iraq while under the operational control of Joint Special Operations TaskForce-North (JSOTF-N). The heavy forces consisted of the HRC and the MRC. The HRC and the MRC equated to a battalion with more than 200 personnel, 5 M181 tanks, 5 M2A2 Bradley fighting vehicles, 10M 113 armored personnel carriers, 4 M1064 mortar carriers, 1M88 tank recovery vehicle, a scout platoon, a Military Police platoon, and a combat service support force enhancement module (CSSFEM). These heavy forces were critical to back up the light infantry operations in northern Iraq.

All sustainment for the forces on the airfield came by delivery from C-17 and C-130 aircraft. Soldiers built up 10 days of supply (DOS) in almost every class of supply relatively quickly, with the exception of bulk fuel. To bring in the heavy assets, Quartermasters needed to meet the conditions set at 22,000 gallons of fuel on the ground. Quartermasters initially established a 30,000-gallon fuel system supply point (FSSP) with one 20,000-gallon collapsible fabric tank and one 10,000-gallon collapsible fuel tank. This provided the storage capacity, but not the fuel. Eventually, this FSSP grew for fuel storage of 80,000 gallons that proved quite a challenge to empty and move.

Local Fuel Purchase

Local purchase of diesel fuel was the first effort at getting the required fuel because all Army vehicles could operate on diesel fuel or JP8 fuel. This was not a big issue because converting from JP8 to diesel does not require any filter changes. However, returning to the use of JP8 is hard because all fuel filters then need changing. We coordinated with the 173d contracting officer for the purchase of 22,000 gallons of diesel fuel. We assumed that since we were in Iraq, fuel should be somewhat easy to come by. However, this was not at all the case in northern Iraq.

Northern Iraq had been cut off from resupply for many years, and the only way to get fuel was from southern Iraq and Turkey. A gas station in northern Iraq consisted of a man sitting by a fuel pump that did not work, with five-gallon cans of fuel. The 173d contracting officer initially contracted for 15,000 liters of diesel fuel to see how well the process worked. We waited a few days for delivery and never received the fuel. Finally, contractors did drive north with a couple of hundred gallons in drums loaded in the back of a nonmilitary pickup truck. Obviously, this purchasing system was not going to work.

The next method we tried was to fill up the FSSP collapsible fabric fuel tanks by using C-17s and C-l30s. This proved a poor system for many reasons. First, the airplanes never seemed to stay on the ground long enough to issue large quantities of fuel. Because of the size of the airfield at Bashur and the threat to the aircraft, the planes were not scheduled to spend more than 45 minutes on the ground. Also, all flights were at night. Fuel operations from an airplane require more time during the hours of darkness. Finally, we never really had an accurate aircraft schedule of when the "bladder" and "wetwing birds" were due with fuel deliveries, which made it hard to have fuelers on standby.

Only One Way

This left us with only one way to get enough fuel on the ground in order to call forward the HRC and the MRC. We had to establish ground lines of communication (LOC). We were cut off from forces in southern Iraq, so a northern ground LOC was necessary. Through outstanding negotiations by the Army Forces-Turkey (ARFOR-T), the Turks agreed to allow fuel flow across the border of Turkey into northern Iraq. We had to send escorts to the Turkish border to pick up the Turkish tankers as they crossed into Iraq. These escorts were critical to ensure that the fuel arrived at the right place. The first convoy from northern Iraq made sure that we had the fuel assets on the ground to call forward the HRC and the MRC. We were finally going to get the heavy forces on the ground to support the 173d.

Just as we were getting fuel systems in place to solidly support the 173d, we were told to take over the forecast and management of all supplies in northern Iraq. The supply and services officer, 201st Forward Support Battalion, 173d Airborne Brigade assumed the mission. While we were providing a daily Logistics Status Report (LOGSTAR) to the Combined Forces Special Operations Component Command (CFSOCC), we were not forecasting fuel for the other US units in northern Iraq.

We began to include the forecasts for the Air Force on Bashur Airfield, JSOTF-N in Irbil, and the Marine Expeditionary Unit (MEU) in Mosul. This proved a very difficult task, but one quickly mastered. We established a reporting chain from these elements that allowed a proper forecast for all units in northern Iraq. However, forecasting proved to be a constant challenge. There was a constant influx of units from all branches of the service into the region following the siege of

Baghdad. Since missions were constantly changing and units were rapidly advancing, we had no accurate way of forecasting their arrivals. Each day a new unit would show up and request fuel support.

Concurrently, the city of Kirkuk, Iraq, became destabilized. The combat forces departed Bashur in order to stabilize Kirkuk and seize the city's airfield. While the 173d headed south, the logistics hub remained at Bashur with all the support personnel. Fortunately, it only took a couple of weeks to open the airfield in Kirkuk because the separation of the combat forces from the logistical hub was a huge challenge. Fifty civilian trucks had to be contracted to support the movement of the supplies and troops from Bashur to Kirkuk.

Overwhelming Diversity

No matter how many trucks we contracted or how many workers we hired, we simply did not have the assets or the manpower to receive, break down and distribute the quantity of supplies required. During the culmination of support, we were supporting more than 7,000 Soldiers in four locations spread over an area spanning hundreds of kilometers. Not only were the numbers great in quantity, but also the diversity was overwhelming. The forward support company (FSC) was supporting heavy mechanized units, aviation assets, special operations groups, the US Air m Force, the US Marines and anyone else who passed through the northern half of the theater in Iraq.

Once the ground LOC from Turkey opened, we had to receive the trucks with Class I (rations) and the fuel tankers at the Harbur Gate on the border of Turkey and Iraq, escort all trucks to Bashur Airfield, on to Mosul for the MEU, then to Irbil for JSOTF-N, finally ending up in Kirkuk. This required extensive coordination and forecasting to prevent fuel tankers from being on the ground too long without being emptied. The supply support activity (SSA) also had to break down all Class I trucks for redistribution to the various other forward operating bases.

To lessen the manpower drainage, we created "the mother of all distribution plans." This plan broke down the commodities by unit loads on trucks. The 200th Materiel Management Center (MMC) in Turkey forwarded us the bumper number and driver listing for each truck and the corresponding unit for which the truck was loaded, according to our distribution plan. We would simply send unit requirements by location, such as Mosul and Irbil; and the personnel in Turkey would verify the appropriate pallet configuration on individual trucks. When our escorts reached the border, they would merely call out the listed names and bumper numbers and then drop trucks off to each unit at separate locations on their way to back to Kirkuk. This procedure stopped the depletion of resources in the SSA and allowed us to operate much more efficiently.

Logistics in northern Iraq was complicated in Spring 2003 and the Joint and Expeditionary Force during Operation Iraqi Freedom was a new concept to all of us, but we worked "outside the box" and thrived. Initial forces in northern Iraq were successful for one reason: teamwork. There were no Air Force, Special Operations Forces, Marine or specific Army units, strictly speaking. We were all one allied team doing what was necessary for mission success in an austere, isolated environment. If a unit needed food, fuel or equipment, we did what we had to do to support each other, regardless of uniform or insignia.

Tremendous Distances

Various units separated by tremendous distances pulled together to provide each other with supplies that the normal supply channels could not seem to provide. While at times it seemed we could barely support our own units with fuel, for example, everyone still gave all they had to keep the other units functioning. We were forced by our circumstances to become a joint team. In the end, we were very successful.

Section 2:
A Quartermaster Unit's Success: Flexible and Capable

CPT James J. Zacchino Jr.

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In synchronization with the transforming asymmetric battlefield, it is imperative that logistical support adapt and provide flexible sustainment to joint war fighting. An expeditionary maneuver concept cannot maintain prolonged and asymmetric fighting with archaic linear supply doctrine and limited assets. In recent Operation Iraqi Freedom deployments, units have proven the adaptability and flexible capability necessary to execute non-conventional support. As joint and combined combat forces engage the enemy, service support Soldiers are operating as multifunctional while maintaining functional skills. Army forces no longer operate to strict pre-Operation Iraqi Freedom modified table of organization and equipment (MTOE) and military occupational specialty (MOS) descriptions. The 109th Quartermaster Company, a 49th quartermaster Group theater asset based at Fort Lee, Virginia, reflects a logistics enabler that operated outside its doctrinal mission and adapted to meet resource requirements in a joint environment.

As one of the only two active duty petroleum pipeline and terminal operating (PPTO) companies in the US Army, the 109th Quartermaster Company doctrinally operates 90 miles of the Inland Petroleum Distribution System (IPDS) tactical pipeline, six pump stations along the pipeline, and a 3.6 million-gallon tactical petroleum terminal (TPT). Petroleum received at the beach head from the US Navy is distributed inland by the IPDS to a TPT supporting corps and theater units in the communications zone. Operating as a PPTO unit, the 109th Quartermaster Company was successful in 2003 as the unit played a crucial role in bulk petroleum supply and distribution enabling the 3d Army combat forces to defeat the Iraqi Army and posture bulk petroleum for subsequent operations in Iraq. In support of Operation Iraqi Freedom V-VII in 2005, combat demands required the 109th Quartermaster Company to operate as an in-lieu of medium truck company assigned to a corps support battalion (CSB) subordinate to the 1st Corps Support Command (COSCOM). The 109th Quartermaster Company, subsequently under the 3d COSCOM, was tasked to transport petroleum by tanker truck in the Marine Corps' area of responsibility in the Al Anbar Province of Iraq. Several field artillery and other non-transportation corps units across the Army were also relied upon to meet increased transportation requirements throughout the Iraqi area of operations.

Operating as a medium truck company was just the beginning of the unit's non-doctrinal and direct support experience. As combat operations evolved in Iraq's western sector and the insurgents changed strategy, the sustainment demands required of coalition forces changed. The fundamentals of mission, enemy, terrain, weather, time available, troops, and civil considerations remained in effect for logistics planning and execution. What changed was the allocation of resources and resources are limited. Units are limited by a lack of Soldiers with certain skill sets and the amount and type of equipment. In accordance with basic economic principles and in order to maintain freedom of maneuver, combatant commanders must have the warfighter's demands met by a dependable and flexible logistics system. Maneuver commanders drive the logistics demand. Logistics commanders must allocate and maximize limited resources to effectively meet demand-driven combat operations. At the company level, the 109th Quartermaster Company represents a resource with an outstanding multiplier that enabled maneuver commanders to effectively conduct combat operations and logistics commanders to maintain the supply chain with flexibility.

Multifunctional

The 109th Quartermaster Company Soldiers' skill sets were primarily comprised of 92F (Petroleum Specialist), 92G (Food Service Specialist), 25C (Radio Operator-Maintainer), 52D (Generator Mechanic), 63J (Quartermaster and Chemical Equipment Repairer) and 63B (Light-Wheel Vehicle Mechanic). Due to the medium truck mission, the company was reorganized from a petroleum-terminal platoon and a petroleum-pipeline platoon, to mirror three truck platoons of a medium truck company MTOE. Other than the light-wheel vehicle mechanics, Soldiers served as 88Ms (Motor Transport Operators). Based on MOS, reorganization, and additional requirements outside the transportation mission, the 109th Quartermaster Company severely lacked platoon and squad leadership. The requirement is for three 88M40s (E7 Motor Transport Operators), one per truck platoon. The 109th Quartermaster Company had none. The 109th Quartermaster Company filled two of the required six positions with 92F30s (E6 Petroleum Specialists) and four with 92F20s (E5 Petroleum Specialists). Eventually, changing battlefield requirements led to constant reallocation of leadership and platoon organization. Initially, a skill level 92F40 (E7 Petroleum Specialist) served as the unit's truckmaster, which is one of the most demanding positions during a deployment. Due to additional requirements, 92G40s (E7 Food Service Specialists) served the majority of their time as truckmasters. Despite the personnel shuffles to meet various requirements and taskings, the 109th Quartermaster Company's assigned CSB primarily viewed the 109th Quartermaster Company Soldiers as multifunctional and capable of serving as motor transport operators, petroleum specialists, and radio operators.

As an in-lieu-of medium truck company, 109th Quartermaster Company Soldiers transported petroleum by tanker truck throughout Iraq's western sector. The battle space included more than 17,500 square miles from Al Taqaddum west to the Syrian border. On 4 June 2006, after nine months of combat service, the 109th Quartermaster Company had conducted 286 combat logistics patrols (CLPs), driven more than 200,000 miles, and delivered over 3.2 million gallons of JP8 fuel, motor gasoline, and diesel fuel. These quantities do not depict the full picture. A typical mission from Al Asad to Al Qaim was a mere 95 miles in distance. However, a CLP took an average of six hours each way. Poor road conditions and a constant hostile threat restricted speed and ease of movement in the battle space. Including preparation and recovery, a mission to Al Qaim in support of the II Marine Expeditionary Force (MEF) was a two-day mission. The direct and general support customers were primarily comprised of MEF units and attachments.

In addition to fuel distribution, the 109th Quartermaster Company participated in dry cargo operations. As the Iraqi population prepared to vote for their constitution in October 2005, the need to secure polling sites dictated 109th Quartermaster Company's mission. The requirement to assist Marine Corps units in support of Operation Liberty Express I to provide barriers to various polling sites in Al Anbar resulted in the 109th Quartermaster Company augmenting an Army transportation company in transporting concrete barriers on flatbed trailers. The successful accomplishment led the 109th Quartermaster Company to shift assets and skills to augment transportation needs on two more occasions. The Quartermaster unit once again supported Marine requirements by transporting barriers to secure various polling sites for the secure voting of the Iraqi parliament in December 2005 (Operation Liberty Express II). The 109th Quartermaster Company also transported vehicles on M872 flatbed trailers to support 3-504th Parachute Infantry Regiment operations in Ramadi.

As the unit provided direct support to maneuver elements, the 109th Quartermaster Company received two M1117 armored security vehicles (ASV) and trained four three-man crews. The trained crews were extremely flexible and able to operate as fuelers, radio operator maintainers, transporters, and ASV gun-truck crews. Based on mission, the ASVs crews augmented a

gun-truck company performing convoy security and escort throughout the western sector. The 109th Quartermaster Company maintained control of the ASVs for several months until they were transferred to a gun-truck company. The ASVs supported nine CLPs and trained ten crews from the gun-truck company.

Modular

Interoperable flexibility is the key to a modular concept. The 109th Quartermaster Company was able to increase logistical capabilities as demand elsewhere on the battlefield changed. Although not a modular template unit, the 109th Quartermaster Company was tasked to provide tailored packages. The plug-and-play packages included a truck platoon, forward logistics element (FLE), a fuel system supply point (FSSP) team, and logistics task forces (LTF).

Personnel and truck assets were routinely reallocated. Increased fuel transport requirements at Al Taqaddum resulted in the 109th Quartermaster Company shifting a platoon-size element comprised of M915 trucks, M1062 tankers, and an M987 wrecker to meet the distribution surge for three weeks. The platoon conducted CLPs to Fallujah and as far south as Tallil. Further, the 109th Quartermaster Company platoon trained elements of a transportation unit on tactics, techniques, and procedures learned in the 109th Quartermaster Company's sector.

The 109th Quartermaster Company led a multifunctional FLE at Combat Out Post (COP) Rawah and provided direct support through command and control (C2), property accountability, fuel transport, and a FSSP team. The C2 element also led teams from various Army combat service support units based at Al Asad to provide maintenance, Class I receipt and storage, and water purification in support of the 4-14th Cavalry and Iraqi Army forces. Within six months, the C2 and property accountability requirements for the 109th Quartermaster Company decreased at COP Rawah as further requirements in the western sector increased. The FSSP team continued to store, receive, issue, and transport JP8, diesel, and motor gasoline fuels. The FLE became permanent and assumed the structure of a LTF.

Due to the ever changing battlefield, the 109th Quartermaster Company led three LTFs during its tour. In support of the 4-14th Cavalry elements operating from COP Rawah to the Syrian border, the 109th Quartermaster Company led a LTF that provided C2 and fuel support over desert terrain north of the Euphrates River. Additionally, the 109th Quartermaster Company was augmented for approximately 60 days with two transportation platoons to perform dry cargo palletized load system (PLS) transport missions. The LTF missions strictly required off-road capable vehicles.

Another LTF at COP North supported a 4-14th Cavalry troop-size element and Iraqi forces in the vicinity of the Iraqi and Syrian border north of the Euphrates River. Before the end of 2005, the 109th Quartermaster Company established a LTF at COP North and provided C2, water transport, and fuel capabilities (storage, issue, and transport). The C2 element also led teams from various units that provided maintenance, water support, and dry-cargo transport. The LTF at COP North became a permanent 109th Quartermaster Company mission requirement. The 109th Quartermaster Company Soldiers operating at the COP conducted numerous CLPs for resupply from Army and Marine Corps hubs. The third LTF operated in a joint capacity.

Joint

As the II MEF conducted combat operations in support of Operation Steel Curtain along the Iraqi and Syrian border south of the Euphrates River, the retail JP8 fuel requirements in cross country terrain had to be met. In order to support the 3-6th Marines, the 109th Quartermaster Company was resourced from the CSB to lead a LTF comprised of C2, fuelers, transporters, heavy expanded mobile tactical trucks (HEMTT), and PLS trucks. The LTF was operationally controlled by Combat Logistics Battalion (CLB) 7 of the II MEF. The joint and forward support operation was successful. They were commended for the quality of direct support the Marines received during combat engagements. The LTF based at Al Qaim returned to Al Asad by the end of 2005 and resumed the bulk fuel transport mission.

In addition to conducting throughput CLPs under Army gun-truck escort and control, bulk petroleum transport missions were also under Marine Corps and Navy control. Gun-truck escort and control depended on the route and convoy composition. The 109th Quartermaster Company conducted CLPs under the operational control of CLB 2, CLB 7, and Navy Seabees. Additional joint missions included direct support to maneuver Marines operating in the vicinity of Camp Korean Village. This mission required two crews of M1088 tractors and M969 tankers to support tracked vehicles. The fuel team was operationally controlled by the Marines.

Other than an operationally controlled relationship, the operating environment required daily interaction with Marines. Not only did the 109th Quartermaster Company deliver petroleum products to Marine Corps operating bases, some of the bases provided 109th Quartermaster Company LTFs with petroleum resupply. To assist CSB operations in support of CLB 7, 109th Quartermaster Company provided a liaison noncommissioned officer (NCO). The liaison NCO provided better visibility and coordination between three nodes. Daily company maintenance and supply activities were also conducted with various Marine elements in Al Asad.

Challenges

The 109th Quartermaster Company overcame some significant obstacles in becoming efficient in all of their operational missions. They became experts in vehicle operations, communications, property accountability, and leadership. Each of these areas were confronted directly by the 109th Quartermaster Company, enabling them to sustain maneuver units.

The 109th Quartermaster Company was introduced to transportation and petroleum equipment not organic to the MTOE. With regards to maintenance, experience in identifying faults and repairing various tankers and trucks was extremely limited. Leadership, research, daily lessons learned, and motivated mechanics were key to the unit being able to maintain the readiness of the 109th Quartermaster Company's 128-vehicle fleet of petroleum and transportation assets. The ten days of truck operator training during pre-deployment did not prepare Soldiers to additionally operate HEMTT tankers, trucks, tankers, and flatbed trailers. Research and an experienced HEMTT NCO were essential in the development of a training program for operating the assigned line-haul and cross-country capable trucks and tankers.

Communications was a challenge throughout the tour. Equipment was extremely limited in an increasing network-centric environment. The unit's hurdles involved communicating from command post to convoy, within a convoy, and from command post to outlying nodes. The Mobile Tracking System (MTS) was the primary means permitting battlefield visibility between command post, convoys, and combat outposts. Single Channel Ground Airborne Radio System (SINCGARS) and Motorola hand-held radios provided internal convoy communications. Due

to the unit's LTF and CLP requirements, communications resources were positioned at several nodes. In order to communicate between LTFs, each node needed at least one MTS. Each 109th Quartermaster Company CLP mission, regardless of node, had at least one of the three communications systems in each truck. The communications systems were reallocated daily to support missions. Among the trucks, the systems were allocated to facilitate information flow in a convoy during a CLP. Not only were the systems limited in quantities, but they were also limited in reliability. The MTS satellite link was occasionally non-operative. MTS component parts were accumulated during the course of the tour to provide repair parts and build additional systems. The unit's communications team learned to install and trouble shoot the systems through trial and error and contractor assistance.

The limited quantity of SINCGARS allowed the fuel commodity NCO/officer in charge to communicate with the gun-trucks and escorts. Very few trucks had cab mounts or vehicle antennae. SINCGARS were used as manpacks in the vehicle cabs. Their range was limited by being used inside the armored cab. During security halts with personnel inside an armored truck, the Motorola handheld seemed reliable between trucks within 50 meters of each other. Once the convoy moved, distances between trucks fluctuated greater than 50 meters. By incorporating all three systems within a mission, communication resources were maximized to increase battlefield visibility and awareness. Yet the unit always struggled due to a shortage of communication systems. The most difficult communication days involved maintaining communications and visibility of four nodes and three CLPs simultaneously.

Maintaining accountability for over $27 million of organization, installation, and theater provided equipment proved difficult. Property was located at Al Asad and at four forward operating bases. Limited communications and geographic separation made the process extremely challenging. Depending on a personnel or equipment surge elsewhere, either the property or hand receipt holder would relocate shortly after receiving a directive. This caused the documentation trail to be outpaced by the directive's requirement. Having more trucks and tankers than operators proved even more challenging as equipment and personnel were spread across the battlefield. Monthly inventories were conducted with reliance on personnel at other locations and in functioning internet and MTS communications. When lateral transfer directives were received, the search for equipment was an odyssey. The intense efforts in tracking equipment, hand receipts, and lateral transfer paperwork resulted in total accountability for equipment and personnel.

Leadership requirements were a concern due to limited leadership experience and LTF and liaison requirements. Although the unit's tailored packages were logistics enablers in direct support roles across the battlefield, the impact was negative at the command post. Deploying with a lack of E6 and E7 personnel, the additional liaison and C2 requirements limited officer and NCO leadership for the medium truck company mission. With most senior leaders located at various locations, company requirements at Al Asad placed more stress on the limited, available leaders and daily transportation operations. Despite only ten days of driver's training at Fort McClellan, Alabama, a limited number of senior leaders, and operating from at least four locations in the Anbar Province, the 109th Quartermaster Company ensured sustainment success. Untiring efforts and sheer perseverance through the painful challenges ended with mission accomplishment and all Soldiers redeployed home.

Future Sustainment Operations

The 109th Quartermaster Company's story is a striking example of the Army's transformation target: a multifunctional, modular, and joint capable organization. The ultimate sustainment team

must perform a myriad of support tasks, understand linear, non-linear, joint roles/responsibilities, and easily operate within/support any organization. These qualities entail smaller and expeditionary logistics enablers that can accomplish more. Despite battlefield, equipment, and personnel challenges, the 109th Quartermaster Company successfully capitalized on resources in joint operations. These agile capabilities allow support units to increase capacity and roles. In turn, maneuver and fire units can accomplish their mission with tailored sustainment. Efficiency will be gained as units are manned according to modular designed templates, Soldiers develop combined skills, service support leaders learn to manage various functions, and units train with interoperable flexibility. With transformation in progress, Soldiers will do the rest. The American Soldier is the outstanding multiplier that will maximize future sustainment operations.

Section 3:
Tactical Logistics and Operation Pacific Guardian in An Najaf, Iraq - A Company Command Perspective

CPT John H. Chaffin IV

Over a career, the professional Soldier memorizes list upon list of tenets and principles. These lists seek to capture a tradition of initiative and ingenuity spanning all ranks - from troops with their improvised contraptions of steel teeth and spikes welded to tanks during the invasion of Normandy, to senior leaders harnessing information networks to mass complex effects in time and space. The principles that embody this tradition also enabled the success of the 364th Supply Company (Direct Support), Logistics Task Force Victory, and the 264th Corps Support Battalion (Airborne) during Operation Pacific Guardian in An Najaf, Iraq during August 2004. The three such principles critical for 364th operations were anticipation, unity of command and flexibility.

Before the Battle

Before the battle the initial concerns were command and control (C2), especially the formal relationship between the 364th Supply Company and augmenting support, and building the right support package at each location as we conducted split-base operations. These decisions were heavily influenced by Army and Marine differences in how to deliver logistics support and the availability of contracted support. One measure of success would be how well we were positioned to provide support during the fight.

As the battle began, the 364th Supply Company was headquartered at Forward Operating Base (FOB) Echo, near Diwaniyah, Iraq. A detachment also was operating at FOB Duke near An Najaf. This area of operations was three hours south of battalion headquarters in Baghdad. From the outset, the 364th conducted split-base operations in support of the 11th Marine Expeditionary Unit (MEU). The company provided potable water from 3,000- gallons per hour reverse osmosis water purification units (ROWPUs), retail JP8, wholesale JP8 distribution using seven 5,000-gallon M969 tankers, direct support (DS) maintenance at FOB Duke with the maintenance support team (MST) from the 659th Ordnance Company attached to the 364th, and field services with the attached shower, laundry and light clothing repair (SLCR) team from the 259th Field Services Company. At the same time, the 364th was establishing its supply support activity at FOB Echo.

Integrating attachments such as maintenance and field services posed no special challenge because corps support battalions often task-organize this way. Reception and integration of small elements was something the 364th Soldiers and noncommissioned officers (NCOs) had done before. As the 364th prepared to receive augmentation, most planning revolved around establishing proper command relationships. The battalion commander chose to attach all elements to the battalion and give me, as the company commander, tactical control (TACON). Negotiation and compromise are parts of this process. Failure to consider all implications of the kind of control allowed to the tactical commander leads to problems in execution. By war-gaming the 364th task organization, we ensured a responsive, agile support capability. Clear command structure facilitated responsive logistics.

Company leadership worked hard to ensure a clear C2 plan during split-base operations. Because of the way the battle space was drawn, the 11th MEU was operating across two provinces and five FOBs. The 364th had to ensure support over the same area. The challenges would revolve around the solid integration of 364th capabilities, the organic assets of the MEU, and contracted civilian logistics within the area of operations.

Getting the right mix of capabilities at each location was fundamental. The joint environment in which we operated in Iraq increased the challenge of building the right initial logistics set. We needed to quickly learn how logistics information flowed, and decisions were made, within an MEU. There is no support operations officer synchronizing plans and execution between operators and supporters. Requirements are developed by the MEU S4 (Logistics) and executed by the MEU Service Support Group (MSSG). How the Marines provide support is left up to the MSSG commander. As an Army unit providing capabilities above what the MEU possessed organically, we had to work with both the requirements generation of the S4 and the support execution of the MSSG. We identified broad requirements early, moved the key capabilities into place and refined those capabilities through routine coordination between the MEU S4, MSSG operations officer, and myself or the FOB Duke detachment officer in charge (0lC). This coordination would prove too slow during high-intensity operations.

Another challenge in developing initial logistics architecture was the integration of contracted services into the decision-making process. A case in point is field services. A civilian contractor provided shower and laundry support at FOB Echo, but not at FOB Duke. Based on the contracting picture, we determined where to position our field services. This information also influenced how we determined the water production effort. In both cases, we capitalized on the contractor's capability without completely giving away our mission. We recognized, with the civilian contractor, that our organizations had different but complementary capabilities. For example, the 364th ROWPUs can desalinate water; but the contractor's ROWPUs, while bigger, cannot. (Water from wells in southern Iraq is often salty.) Therefore, it was important to meet the contractors, learn their capabilities and limitations, and develop agreements on how we would work together.

During the Battle

On the morning of 4 Aug 04 a Marine UH-l aircraft went down over the city of An Najaf. This event triggered fighting that developed in intensity and complexity during the next three weeks. At its height, the operation involved the equivalent of six battalions of Marine, Army, coalition, Iraqi and aviation assets. The 364th Supply Company was the only direct support logistics unit in this area of operations. As the battle progressed, we would be required to receive attachments that would bring our strength up to 275 Soldiers.

The battle focused on two pieces of interrelated terrain, both of significant cultural importance to the Muslim community: the Najaf Cemetery (the largest cemetery in the world) and the Imam Ali Mosque (the second holiest site in Islam). The complex urban terrain, coupled with the battlefield's cultural and political significance, shaped our logistics operations. The greatest challenge, however, came not from the fight itself, but from the theater logistics architecture.

Within days of the start of combat operations, the 364th Supply Company's greatest enemies were time and distance. In order of priority, the commodities critical to sustaining the fight were fuel, ammunition and water. The lines of communication (LOC) over which we had to operate were defined by the MEU battle space and the theater logistics architecture. Within the MEU battle space, 57 miles of bad road separated FOB Echo from FOB Duke. Our source for bulk

JP8 fuel was over 160 miles of even worse road, and a single round-trip fuel mission required Soldiers to drive 320 miles in l30-degree heat. During the battle, the 364th Supply Company would routinely be spread across 220 miles of desert with date palms and mud huts. Because three hours was the best response time we could achieve for an emergency push of supplies from FOB Echo to FOB Duke, accurate estimates were essential.

In the case of bulk fuel, the mission was threefold: to reach back over the LOC with organic and attached fuel tankers from FOB Duke to our source of supply, maintain and operate two fuel farms, and push fuel from FOB Duke to outposts in the edges of An Najaf two to three times a week. This LOC was the longest route in our area of   operations. Fuel was the also the most complex mission overall.

As a result, wholesale JP8 distribution commanded most of our attention throughout the fight. Sustaining the steady flow of fuel was vital to the mechanized formations the 364th supported. The most important consideration was keeping crews fit for the 320-mile trip. The G1/G4 Battle Book defines linehaul operations as a round-trip distance that can be traveled twice per day. This LOC was something beyond line-haul. Army doctrine suggests tactical units do not do this sort of mission.

Success would require some creative planning and great NCO leadership. Early in the operation, the 364th received two separate teams of M969 fuel tankers, giving the company 12 tankers we could count on to line-haul fuel. We created two fuel teams, complete with gun truck security elements. We kept these teams together, to include convoy commanders, throughout the operation.

We then built a schedule that had each team on the road for two days, with a "down" day, and then back on the road. A given team would be on the road 4.5 days out of each week. As Soldiers became familiar with the route, safe travel time became about 5.5 hours one way. By using one day per "leg," soldiers got rest in the middle of each mission. The "down" day was then used for maintenance in the morning, then more rest in the afternoon. We thought this rhythm was sustainable for the time we had to execute reach-back for fuel.

This was a sustainable rhythm until two battalions of the 1st Cavalry Division arrived at the start of the second week of fighting. The 364th now had three mechanized elements, plus aviation, in our area of operations. We decided that if we could briefly surge our wholesale distribution capability, we could then revert to our planned rhythm and sustain for the duration of the operation. The single theater push of fuel we received during the battle came earlier than expected. We capitalized on this windfall to delay one fuel mission for one day, which enabled each team to make subsequent back-to-back runs with no "down" day.

NCO Leadership

It was during this period, about the second week of the fight, that NCO leadership became the key to success. Enforcing rest plans and staying sharp on precombat checks (PCCs) and precombat inspections (PCls) enabled us to surge temporarily in order to keep up with the flow of operations. We did this with no combat losses, no injuries and no days lost to vehicle maintenance or illness.

Because bottled water was abundant before the battle, the supply of bottled water never required a surge or change in rhythm. The concept of water support was a constant. This remained true

even as new units continued to pile on. Due to this influx of warfighters, consumption rates and on-hand quantities of water constituted a key piece of information. This information became a transportation enabler.

Staying Responsive

By not having to react blindly to an imagined shortage of water, we were able to free up ground transportation to move ammunition. This information enabled our support to stay responsive to the warfighter's priorities. Because of the size of the force the 364th Supply Company supported and also the tremendous distances we had to travel to deliver support, knowing exactly what we had and how much of it we would have in a few days constituted essential data throughout the operation.

We moved bottled water with a palletized loading system (PLS) platoon we had received just before Operation Pacific Guardian began. This capability had enabled us to build up a sustainable stock of bottled water. As the fighting intensified, this element was also used to move ammunition. Our visibility of bottled water stocks enabled us to keep two PLS systems reserved for on-call ammunition transport requests from the MEU. Since the bottled water was next to the ammunition supply point for southern Iraq, we integrated these PLSs into the water mission. Seeing an opportunity and being in a position to seize it allowed the 364th to provide a capability that had not even been identified as a requirement before the start of the fight.

As the fight entered its second week and Operation Pacific Guardian approached its culminating point, some critical types of ammunition were running low. The particular ordnance was Marine-specific and could not be moved during our routine water mission using "opportunity" PLS. Again, by keeping careful track of our on-hand commodities, we were able to shift our PLS schedule. We built in an emergency reach-back operation to a Marine ammunition supply point, picked up the necessary ammunition, and got back before the specific rounds were depleted. All 364th ammunition transport missions were only possible because of careful asset visibility. Without this critical information, we would not have been able to develop an ammunition supply plan "on the fly." We would have required further augmentation: additional assets that probably were not available.

Throughout Operation Pacific Guardian, continuing to revise estimates and plan accordingly were the keys to our success. Because of the complex terrain and the political sensitivities involved in fighting around the mosque and the cemetery, the Marines depended on careful planning and resource allocation. It was not feasible to simply blast holes through the city in order to engage insurgent forces. Instead, precision fires - from snipers to laser-guided munitions - were used to limit collateral damage.

This had a tremendous impact on logistics. The relatively small transportation section of the MEU was required to navigate narrow streets with low hanging wires and debris to deliver supplies to widely separated elements. The tactical supply routes tended to radiate through the city like spokes, with few cross-mobility corridors. As a result, the availability of organic lift to conduct resupply operations was extremely limited. Our ability to augment that lift by conducting wholesale supply transportation operations was therefore a very real asset. While most of the wholesale resupply was by air, on at least two occasions our ability to get emergency supplies for the warfighter ensured assets were available for tactical resupply missions.

Before Operation Pacific Guardian, the 364th conducted coordination with the MEU S4 through company command channels. As the fight developed, this proved too cumbersome. Between

split-base operations, continuous convoys and multiple logistics capabilities, execution was all-consuming. There was little time to validate new requirements.

This problem was resolved by the addition of a battalion support operations liaison officer (LNO). This LNO was virtually embedded within the MEU S4 and served to gather and complete initial validation of all emerging requirements. This allowed Logistics Task Force Victory to maintain clearer visibility on what was happening in An Najaf, which in turn led to faster and more efficient allocation of resources. Adding an LNO also freed key leaders within the company from spending time on requirements that were clearly beyond the company's capabilities, allowing us to focus on the mission.

The other significant challenge for the 364th was the integration of new Soldiers as we continued to expand our capabilities. At its peak, the 364th "Guardian Eagles" numbered 275 soldiers. We were performing tactical fuel distribution; wholesale linehaul of fuel; bulk fuel storage and issue; providing Class II (general supplies), Class III (petroleum, oils and lubricants), Class IV (construction and barrier materiel), Class V (ammunition), Class IX (repair parts) support; PLS medium transportation support; heavy equipment transporter (HET) support; DS maintenance; field services; and potable water production. The 364th operated five out of six tactical logistics functions within one company headquarters.

This would not have been possible without using common sense to integrate short-term augmentation. Our focus was almost entirely on the mission. As far as military discipline, the 364th focused on the basics. The commander or detachment OIC visited each work area every day, and the first sergeant or detachment NCOIC visited living areas every day. We conducted a nightly Battle Update Brief (BUB) and a daily ground movement order. Orderly rooms were very focused on personnel accountability.

Also, short-term (less than 30 days) attachments to the 364th were held accountable only for mission conducted safely, energetically and to standard. The 364th provided additional command support as needed, from providing DSN telephone access to coordinating airlift for a platoon so its Soldiers could attend a memorial service in their parent company.

After the Battle

Logistics is largely a game of numbers. Whether discussing time, distance, quantity received or quantity required, logisticians always are talking about numbers. The success of the 364th Supply Company during the battle of An Najaf is shown by the "Key Assets" and "Productivity" charts of the company's capabilities and productivity, 12-25 Aug 04.

Key Assets
12-25 Aug 04

Peak personnel: 275
Fuel trucks: 17
3K ROWPUs: 3
Ullage in fuel farms: 320K gallons
Potable water storage: 189K gallons

Productivity
12-25 Aug 04

Fuel:

> **Received**: 400K gallons
> **Issued**: 300K gallons
> **Convoys**: 14
> **Miles traveled**: 4,000

Water:

> **Procuced**: 1,250,000 gallons
> **Issued**: 1,100,000 gallons

Palletized Load System:

> **Pallets moved**: 985
> **Convoys**: 24
> **Miles traveled**: 3,400

These are only some of the statistics describing the 364th logistics effort required to support *Operation Pacific Guardian*. The hours spent on materials handling equipment (MHE) missions or operating retail fuel points will never be fully accounted. Of course, the hard work of the 364th Warrior Logisticians is more than simple numbers. Their hard work is a reflection of their pride and professionalism. In the final analysis, supply statistics reflect the commitment of each Soldier on the ground and nothing more, or less.

Principles

The 364th began by acknowledging a tradition of creativity and ingenuity, a "can-do" attitude. Based on common sense, our operating principles will assist any logistics company operating far from the flagpole in the complex arena of Iraq.

The most important principle for logistics success in the fighting at An Najaf was anticipation. From our initial logistics set to developing requirements and capabilities in the midst of the battle, the 364th Supply Company maintained its ability to support the warfighter because the company was always looking ahead. This required close coordination with civilian contractors and joint military organizations. It was also necessary to carefully monitor consumption of key commodities. In whatever way at whatever time, we were always trying to see the way ahead.

Another key principle was unity of command and unity of effort. The 364th worked hard to clarify exactly how each element fit into the larger picture. As units and capabilities were added, we developed a simple, easy-to-execute routine for maintaining C2. Leaders remained visible and present throughout operations. All decisions came from or were approved by the company commander. Subordinate leaders understood the importance of not allowing any external organization to task the company without going through the proper channels.

Though other logistics principles were at work, the final significant principle for the 364th was flexibility. We experienced this principle as the ability to act on critical information and seize opportunities as quickly as they arose. We were able to make a significant contribution to the warfighter by assisting with ammunition transportation, for example, and we could do this only because we could accurately visualize our entire operation. Communication within the company was absolutely critical in order for us to rapidly shift assets and missions without falling into chaos. Flexibility was largely the contribution of the NCOs and Soldiers who made the mission happen each and every day during *Operation Pacific Guardian*.

The 364th Supply Company's support of the battle 5-27 Aug 04 in An Najaf was a success. For achievement, we tackled key objectives before and during the operation. Before combat, the 364th focused on establishing the right mix of capabilities and developing support relationships. During the fight, the 364th focused on providing fuel, ammunition and water to the warfighter. Anticipation, unity of command and flexibility contributed the most directly to mission accomplishment.

Section 4:
Forward Logistics Element Officer in Charge Lessons Learned

CPT Juliana E. Ledgister

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A supply and services officer of a combat sustainment support battalion (CSSB) is responsible for the management of all classes of supply (minus Class VII and VIII), as well as management of showers, laundry, and clothing repair operations across the battlefield. One CSSB that was located in Al Asad, Iraq, was responsible for all general support and direct support of customers that included Army, Marine Corps, Air Force, Special Operations Forces (SOF), and the Iraqi Army multinational forces in the whole west area of operations. That is a very large footprint.

During Operation Sayid and the first Iraqi elections, a small command operating post named Rawah was established near the Syrian border. This was in the CSSB's battle space and the supply organization was charged with setting up and supporting a very small common operations platoon located in a remote and austere location. The CSSB supply and services officer was sent forward to support US military personnel that would be operating in this area. Later another requirement for the same kind of support came for the city of Hit. Again, the CSSB supply officer was relocated to support the Marine Corps and then later Task Force, SOF, and Iraqi Army forces.

This kind of duty can have its own peculiar difficulties, so here are a few tips on some of the things one might face if they find themselves assuming the duties of a forward logistics element (FLE) officer in charge (OIC). Many of the situations discussed are not found in doctrine and Soldiers often found solutions through trial and error. These actions eventually helped the support of customers as well as made life for Soldiers a lot easier.

Communication Systems

If you are separated from your flagpole (CSSB), the most important thing to have operating is communication. Success in Iraq depends largely on the daily communication between the battalion and the supply officer. Communication with the battalion and the FLE is not always dedicated. The Marines operated on a different secure internet protocol router network (SIPRNET) than the battalion and it was often difficult to make contact. It is vital that the FLE supply officer have a dedicated line of communication for adequate support. In order to communicate, the supply officer may have to use the movement tracking system as a means of communication. If it is determined that a FLE is needed, it is vital to establish a concrete means of communication prior to sending the element forward. A good recommendation for austere locations is to have a satellite phone available. It can be a great lifeline. Another good recommendation is to have your S6 channels determine what type of line your supported customer has. In one example a Marine customer only had SIPRNET channels. The supply officer supporting the Marines had to establish an account with the Marine Corps unit before being able to communicate with the battalion via SIPRNET. Although it only took a few days to establish an account, it would have been easier to already have one before getting on the ground.

Taking Over a Class I Stockpile

It is not always easy to provide initial support to units once on the ground. An FLE OIC may lack knowledge of what is on hand in the Class I yard or the serviceability of rations. One such Class I yard did not have enough people on hand in order to dedicate the time it took to accurately monitor rations. Class I material would be delivered to the forward operating base (FOB) and unloaded, but not accurately accounted for. Rations were not stored in a secure location, so rations were sometimes pilfered. This in turn caused an inaccurate accounting of rations. When the new FLE team arrived, they inventoried all rations, obtained connexes to secure them in, and maintained an accurate count of what was on hand once the logistics packages were delivered. Initially it was a lot of hard work sorting the rations and figuring what was still usable stock, but once the yard was organized, it was easy to maintain. It helped the operation to have dedicated 92Gs (Food Service Specialists) on hand in order to organize rations and maintain them at the site.

Transporting Bottled Water

Due to rough terrain and poor roads, water would sometimes arrive at austere locations in bad shape. It could not be downloaded with a forklift. Soldiers had to unload multiple pallets of water by hand slowing convoy turn-around time. The battalion tried several different methods of transporting the water and found that transporting water in connexes that were blocked and braced proved to be the best method. It limited the amount of space and number of pallets, but helped solve the problem. Ensuring that pallets were not stacked higher than four high and were topped with black toppers (like those on multi-pack boxes) and ratchet strapping securely when traveling on flatbed or on a palletized load system also prevented problems.

Maintenance Support

It is critical that material handling equipment (MHE) and rough terrain cargo handlers are available at forward locations for both the FLE and the supported customer. It is also vital that there are dedicated operators for each piece of equipment. There is little time for on-the-job training when you are in the middle of the fight. Have at least one dedicated operator/maintainer on hand for each piece of required MHE, two dedicated operators/maintainers would be ideal in the instance that one piece of equipment goes down. Try having a maintenance support team available. Also, a 63J (Quartermaster and Chemical Equipment Repairer) on hand will not only fix equipment but also anything else that breaks down.

Operations run well with an entire mechanic support team (MST) dedicated to the FLE. The MST must be composed of a heavy wheel mechanic, a welder, air conditioning and refrigeration mechanic, MHE mechanic, and a Unit Level Logistics System-Ground (ULLS-G) operator. Where this is not available there needs to be at least one dedicated mechanic that is knowledgeable on MHE. It is also highly recommended to have a dedicated very small aperture terminal to file transfer protocol from ULLS-G to Standard Army Maintenance System-1 Enhanced to ensure parts are ordered and received in a timely manner.

Finally, outstanding Soldiers who work hard and are dedicated to their mission can accomplish almost anything. Being an S1 and then a supply and services officer during conflict can teach one more in a year than some individuals learn during a whole career. These tips are offered to help make your deployed life a lot easier.

Section 5:
Tracking Materiel from Warehouse to Warfighter

Lt. Col. Joseph P. Granata, USMC

New tracking technology enables Marine Corps logisticians to tackle "the last tactical mile."

After-action reports of Operation Iraqi Freedom (OIF) issued early in 2003 heralded the success of radio frequency identification (RFID) systems and networks that profoundly enhanced the ability to track in-transit materiel from the continental United States (CONUS) to the theater. According to the reports, the military, especially the Army, benefited from greater visibility of materiel, reduced inventory, and increased speed in locating critical supplies.

However, those reports and OIF operational experience also showed that, once RFID-tagged shipments were broken down at in-theater ports and airfields for forward movement to the warfighter, accountability for the items in them was soon lost. The truth is that, during both the buildup and execution of OIF, the military did not track supplies to the tip of the spear. The result was the loss of equipment, gear, and other supplies and a lot of reordering. Some units, including Marine Corps units, were not using RFID, which further exacerbated logistics problems.

In the end, Marine Corps logisticians were humbled and embarrassed by some of the "nuts and bolts" logistics problems they encountered. Because of these problems, marines often did not have what they needed. They squandered a great deal of time and treasure worrying about logistics management problems whose solutions were potentially at their fingertips.

Finding Solutions

My unit, the Marine Corps' Supply Management Unit at Camp Pendleton, California, is the primary supply support unit for the I Marine Expeditionary Force. When we returned from our OIF tour, we understood the imperative to make changes to our supply process—and quickly. We recognized, at least at some level, the role that RFID potentially could play in fundamentally changing the way Marine Corps combat service support groups serve the end users in the foxhole.

We did not waste any time. We knew that tracking materiel to ports or airstrips and then losing it would do little to transform our processes. While we were late in getting into the RFID game, we sought to make up ground quickly by focusing on the so-called "last tactical mile" shortfall still so evident at the far end of the delivery chain. We sought to extend the near-real-time, in-transit visibility (ITV) of the logistics supply chain that we enjoyed at the strategic level down to the tactical level and, in fact, all the way to our final consignees—the warfighters. When the assault on Fallujah, Iraq, took place last fall, we were ready to support the warfighter with what he needed when he needed it.

When the Marine Corps redeployed to Iraq in February 2004 in what might be called "OIF II force sustainment," we used a new RFID concept that quickly moved the Marine Corps to the forefront of emergent military logistics solutions. The concept involved the following—

- Attaching active, battery-powered RFID tags to materiel so that it could be tracked as it moved through the supply system to the consignee in theater by the lowest possible conveyance level.

- Instituting robust training of personnel before deployment from CONUS.

- Using portable deployment kits to set up checkpoints at each major camp, and eventually at the battalion level, to ensure automatic visibility of shipments throughout the retail supply chain.

Tagging to the Bin Level

To address the issue of inadequate in-depth visibility of materiel, we began comprehensive implementation of RFID tagging down to the pallet or reusable tri-wall container level and even to the bin or SKU (stockkeeping unit) level. When supplies for multiple consignees were on the same pallet, we tagged separate bins of materiel on the pallets for the individual consignees. The individual items inside the bins were bar coded, and the bar code data were uploaded to the active tags, which have a capacity of up to 128 kilobytes of data. During the conflict in Fallujah, we were able to track materiel in near-real-time all the way to the edge of the city.

In contrast to the Army's practices, the Marine Corps tags materiel even if we know it will be passing through areas that do not have interrogators. We do this as a matter of policy to institutionalize the proliferation of interrogators in the future so we will be able to tie the data feeds into existing inventory management reports and systems. Tagging materiel so it can be tracked wherever interrogators are available helps us to keep our supplies where they belong and "know what we have where" with a business-like efficiency.

Training As We Fight

The Marine Corps philosophy of "train as you fight" was central to finding a solution to our logistics challenge. In just a few weeks, we implemented a unit-level training program to ensure that new personnel in the unit were competent users of RFID technology. We believe that training personnel to use RFID technology during support operations in the United States helps to promote its use routinely in all operations rather than only during deployments. Currently, this approach to institutionalizing RFID is unique to the Marine Corps. The approach is so successful that the Corps is now providing assistance and training support to deployed Army supply support activities.

In-Theater ITV

Commercial off-the-shelf technology was pivotal to expediting RFID system implementation. Working closely with the Installations and Logistics Department at Headquarters, U.S. Marine Corps, we identified hardware and software early in the process that would help us meet our required nodal visibility objectives.

Within months, we were able to deploy compact, lightweight early-entry deployment support kits and mobile readers in the field along key nodes all the way to the Syrian border. These new mobile RFID stations provided in-theater ITV that showed current events at the container, pallet, and bin levels.

We also extracted "last known location" data from the ITV server and used it to create shipment status information that was posted to the units' standard supply management reports. This provided an audit trail of shipments as they passed through locations in the distribution pipeline (for example, the containerization and consolidation points at New Cumberland, Pennsylvania; Charleston, South Carolina; and Al Taqaddum, Balad, and Fallujah, Iraq).

Today in Iraq, through the use of a custom interface between the Automated Manifest System-Tactical (for which the Army and the Marine Corps share responsibility) and the Marine Corps supply system, RFID automation allows seamless collection of source data for outbound shipments of reusable tri-wall containers and pallets to marines in the field. With the implementation of the new tracking systems, Marine Corps logisticians are able to use the Joint Deployment and Logistics Model (JDLM), which is also used by the Army, to track shipments as they move forward.

Marines love being "in the know" and never plan to go back to the "good old days." The new tracking capability enables better planning, reduces unnecessary backup orders, and, most importantly, instills greater confidence in logisticians and warfighters alike.

The Payoff: A Shift in the Logistics Paradigm

Today, our new tracking capability provides us with cradle-to-grave status of supplies with unprecedented accuracy and resolution. We have tagged hundreds of containers and thousands of pallets holding tens of thousands of supply items and experienced better than 90-percent read rates in hostile environments throughout the supply chain.

The new RFID process has enhanced the precision and flexibility of our supply operations, and we have gained the ability to locate or redirect "misroutes" as soon as they happen. We can prioritize shipments like never before; for example, critical repair parts for tanks are shipped ahead of pens and paper.

As a result of these improvements, we have reduced our overall shipments while pushing materiel to the end user more quickly. Supply personnel know what they have ordered, where it is, and when they can expect to receive it. Allowing logisticians to see progress with their own eyes has increased their confidence in the supply system. As a result, just in-case ordering has decreased substantially.

The Marine Corps has a long way to go to exploit the maximum potential of RFID technology to enhance supply support operations. Our experiences in supplying the 1st Marine Division, I Marine Expeditionary Force, for the offensive on Fallujah demonstrated that our forward-leaning approach is battle forged and that the payoffs are real.

Section 6:
Improved Air Cargo Operations

SFC Lupe G. Galvan

To reduce the number of coalition vehicles and personnel required to travel Iraqi roads to deliver ground cargo, the Army's 1st Corps Support Command and the Marine Corps' 1st Marine Expeditionary Force worked together to find a way to increase the amount of cargo being flown into the Iraqi theater. Their efforts resulted in the creation of the Joint Air Cargo Operations Team (JACOT). The JACOT, the first interservice team of its kind, coordinates air assets in Iraq.

Before the establishment of JACOT, interservice cooperation was limited. The Marine Corps operated traditional arrival and departure airfield control group (ADACG) operations. It was responsible for loading and unloading passengers and cargo arriving on Marine Corps helicopters and fixed-wing aircraft. Across the airfield, an Air Force aerial port team and the Army's 3d Platoon, 403d Cargo Transfer Company (CTC), loaded and unloaded all cargo from other fixed-wing military aircraft and commercial carriers. This operation worked, but it was inefficient.

In June 2005, the Marine Corps 2d Force Service Support Group Forward and Combat Logistics Regiment 25 took the lead in transitioning the ADACG and Strategic ADACG into the JACOT. The transformation included collocating the personnel movement side of the operation with the cargo movement side, including the transient billeting area for incoming and outgoing units. The efficiencies gained were vital to the successful deployment and redeployment of Army units in July, when over 8,000 Soldiers passed through the JACOT area of operations.

JACOT Organization

The JACOT is unique because it involves all four military services. It now consists of an Air Force tactical control element team, the Marines and Sailors of the 1st Force Service Support Group, an Army movement control team, and the cargo handlers of the 403d CTC.

The Air Force tactical control element team brought the much-needed Deployable Global Air Transportation Execution System (DGATES) technology to the operation. DGATES allows the JACOT to track all aircraft that pass through and the amount of cargo and personnel on each.

JACOT Operations

The division of labor is what sets the JACOT apart. The Air Force tactical control element team schedules flights, tracks incoming air assets, and observes all moving equipment on the airstrip to ensure that it is operated correctly. When an aircraft approaches the field, Marines and Airmen working in the air control tower notify the offload team—consisting of Marines, Soldiers, and Airmen—waiting at the intermediate staging point. When the aircraft ramp is lowered, the joint team offloads the cargo. The average offload time for a full C–17 is about 20 minutes.

Once the cargo is staged at the intermediate staging point, the Army team moves the cargo into the cargo yard, where it is sorted into designated lanes by Department of Defense Activity Address Code or Reportable Item Control Code. The cargo then is transported by ground to customer units within 24 hours.

The JACOT concept has proven to be very successful in Iraq. One benefit of having one central air cargo operations team for the Iraqi theater is that it provides a one-stop shop for cargo and passengers. The team has been able to use aircraft more efficiently and, as a result, has maximized air transport of passengers and cargo. Another benefit of the joint team is its ability to share resources, which has reduced manpower and equipment requirements for future operations.

As one JACOT member put it, "We're one team. We're here for one fight. We do the same thing; we help each other out. It's a good feeling."

Section 7:
3D Platoon Takes on Triple Mission

By CPT Sonise Lumbaca

Reprinted with permission from the Winter 2005 issue of *Quartermaster Professional Bulletin.*

TAQADDUM, Iraq - Thousands of pounds of supplies are flown in via fixed and rotary-wing aircraft or driven in by combat logistics patrols to staging areas each day. The various supplies, which include bottled water, equipment parts, and ammunition, are brought in from various locations and countries to aid u.s. troops in Iraq.

Once all of these supplies arrive, who determines what goes where and when? Members of 3d Platoon, 403d Cargo Transfer Company, 620th Corps Support Battalion, 561st Corps Support Group, an active duty unit from Fort Bragg, North Carolina, has the mission of receiving inbound supplies and dispersing them to various units of all services.

The platoon of approximately 40 Soldiers, which arrived in mid January, is responsible for three areas of this operation which operates 24 hours a day: the Joint Air Control Operations Team (JACOT), Central Receiving Shipping Point (CRSP), and the Logistics Support Area (LSA) Operations.

Once called the Air Departure Airfield Control Group, the JACOT mission has evolved into a joint mission involving the Army, Marines, Navy and Air Force. The JACOT is responsible for moving cargo by air. The operation is simple, upload and download Air Force and Marine Corps aircraft, mainly C-17s and C-130s.

The Marines download the rotary-winged Aircraft and we download Air Force pallets and transport them to a cargo yard where the cargo is tracked and facilitated to the correct units. All four branches of the service work together to facilitate the moving of this cargo.

The JACOT was formed in order to mitigate combat logistics patrols. It is the first of its kind in the Iraqi theater. About 12 members of the 3d Platoon operate the ground portion of the JACOT mission which entails operating various equipment including the Air Force 25K and 40K loader and the Army, Marine, and Air Force 10K rough-terrain forklift. K-Loaders are cargo-loading systems used to load pallets onto aircraft.

Soldiers have been cross-trained on this equipment by the other branches. The joint training helps to accomplish the mission without flaws. Soldiers like their job because it is eventful and develops good skills as far as the technical trade goes. The job is challenging and keeps them on their toes.

The CRSP mission, an operation run by 11 Soldiers, is to receive supplies and equipment in a staging yard and distribute the Army cargo from incoming combat logistics patrols to units here and other forward operating bases. The CRSP yard is also a staging area for combat logistics patrols traveling to various other locations in Iraq and Kuwait. The Soldiers that operate the CRSP yard not only are responsible for cargo documentation, but also operating material handling equipment (MHE), which includes container handlers to load and unload 20 and 40 feet containers, and the 10K variable reach forklift that loads 463L Air Force pallets.

A container handler is machinery that can be driven through rough terrain with the capability to load and unload large containers on to flatbed trucks, rail cars, and on the ground.

The unit tracking number is written down, weight, and the day the equipment was picked up in order to keep track of what comes in and out of the yard. There are many different units that get cargo that is sometimes not supposed to be there. It must be tracked down and measures taken to be sure it gets to the right location.

Members of the LSA Operations cell are responsible for providing support throughout the entire camp here. They load up combat logistics patrols and travel throughout Iraq providing support. Additionally, they provide MHE support, which includes the operation of a 40-ton crane to move heavy equipment for units that do not have this type of support. More than 6,000 pieces of equipment and freight were distributed over the past seven months. There are some challenges. The biggest challenge in Iraq is the weather and keeping the equipment mission capable. The sand storms damage the Kalmars and 10Ks in everyday usage.

The unit is able to meet the challenges with experienced Soldiers within the platoon. They have maintenance teams on hand that keep equipment from falling apart and replacement parts are bought ahead of time. So far the unit has not dropped a mission for non mission capable equipment because of the fine job they have been doing. Members of 3d Platoon enjoy their jobs because they are doing what they were trained to do.

Chapter 2: Tactical Logistics Supporting the Warfighter for OEF

Section 1:
10th Forward Support Battalion 'On Steroids'
Supporting Full-Spectrum Combat Operations

LTC Rodney D. Edge

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Putting together the right support package in southeastern Afghanistan to sustain a coalition task force consisting of more than 5,000 Soldiers responsible for an area the size of the state of Texas appeared to be a very daunting and arduous task on paper. The Army's FM 63-20 (Forward Support Battalion) in the combat service support series did not lend itself to being the proper blueprint to guarantee success from a doctrinal standpoint in this type of combat operation. Instead of the normal brigade support area (BSA) or field train support concept, mission success July 2003-May 2004 during Operation Enduring Freedom IV meant that Soldiers and junior leaders had to be proficient in requisite skill sets and basic core competencies at the collective and individual levels. Mission success was defined in terms of accomplishing everything required to meet the needs of the warfighters through nondoctrinal means.

Developing the right mix of sustainers and medical personnel for support was not easy during Operation Enduring Freedom IV. An even bigger challenge was deploying a light forward support battalion (FSB) into combat, in essence with all new senior leadership. The mission of the 10th FSB was to sustain full spectrum combat operations and humanitarian operations of the 1st Brigade Combat Team, 10th Mountain Division (Light Infantry). This was a coalition brigade task force that included French, Romanian, Afghanistan Militia Force (AMF) soldiers, Afghan troops and mostly US Army Soldiers as Operation Enduring Freedom continued. The 10th FSB mission also included area support to the US Air Force, US Marines, and the many contracted personnel and humanitarian organizations operating at or near Kandahar Army Airfield in Afghanistan.

The 10th FSB deployed to Afghanistan with a new battalion commander, executive officer, support operations officer, combat health services officer, battalion S3 (Operations Officer), battalion S4 (Logistics Officer), two new company commanders, two new first sergeants and several new lieutenants. Most had assumed command or positions of responsibility only 45 to 60 days before deployment from Fort Drum, NY. Everyone understood that any and all lags in training and leader synchronization had to be corrected in the 10th FSB's forward area of operation. The division support command (DISCOM) commander, previous battalion commander and staff's mission analysis determined that a light FSB of 188 Soldiers would not be able to fully achieve mission success without many enablers from the assigned corps support battalion and other DISCOM units such as the materiel management center, sister FSBs and main support battalions (MSBs). The 10th FSB's total strength grew to more than 450 Soldiers.

Tactics, techniques and procedures (TTPs) for Operation Enduring Freedom IV were learned at an extraordinary pace after arriving in Afghanistan and were incorporated into the 10th FSB 's Relief in Place (RIP) and Transition of Authority (TOA) from the 307th FSB, 82d DISCOM, Fort Bragg, NC. Initially, accelerating TTPs and acclimating Soldiers to altitude and extreme weather conditions were the catalysts for mission success. The FSB commander's intent was simple and relied on these three criteria: "Nothing fails due to logistics," "Risk analysis and safety will be

incorporated into all we do," and "All missions will be thoroughly rehearsed before execution." Situations that would appear complex became relatively easy after all leaders understood the basic intent and then Soldier skill sets and core competencies were tailored for the environment.

Supply

Transportation and Movements

The geography of southeastern Afghanistan coupled with force protection issues - predominantly concerns about ambushes and improvised explosive devices (IEDs) of enemy Taliban forces and the anticoalition militias - were key factors in movement. It was virtually impossible to use the Army's FMTV ILMTV (family of medium tactical vehicles/light medium tactical vehicles) and platform loading system (PLS) for ground convoys to sustain 151 Brigade Combat Team elements operating out of forward operating bases (FOBs) throughout the coalition task force's area of responsibility. After considering the long distances, small mountainous trails, unimproved roads and altitudes ranging from 3,000 feet to more than 9,000 feet, the 10lh FSB had to rely on local host nation trucks (nicknamed "Jingle Trucks") and drivers as the primary way to distribute commodities to support warfighters forward. The key to making "Jingle Trucks" work to the Army's advantage was to assign a congenial 88N (Transportation Movement Coordinator) known affectionately as the Army's "Jingle Man" to work with local nationals. Aerial delivery methods including "kicker pallets," Container Delivery System (CDS) and sling load were other alternatives for orchestrating routine and emergency resupply forward without putting Soldiers in convoys and exposing them to many unknown dangers. The use of "Jingle Trucks" provided more comfort and ensured that Soldiers' lives were saved. At the same time, "Jingle Trucks" reduced the reliance on air frames normally required to push supplies forward.

At Kandahar Army Airfield, the 10th FSB had operational control of a movement control team from the 330th Movements Control Battalion, Ist Corps Support Command (COSCOM), Fort Bragg, NC. The movement control team was assigned to the Joint Logistics Command in Bagram, Afghanistan. These officers and Soldiers who performed airfield departure/arrival group functions were assisted by Soldiers from the 710th MSB and 10th DISCOM Movements Control who had the responsibility of performing container release point tasks.

Class I

Modem doctrine states that light FSBs should have no more than two days of supply on hand to sustain combat operations. During Operation Enduring Freedom IV, the 10th FSB operated what was, in effect, a troop issue support activity staffed with up to 40 Soldiers with the 92A (Automated Logistical Specialist) military occupational specialty. On average, the 10th FSB had 30 days of Unitized Group Rations-A/B (UGRs-A/B), specialty meals, and Meals, Ready To Eat (MREs) on hand with supplements such as fresh fruits, vegetables, juice and sodas. This was indeed indicative of an FSB conducting a MSB/corps support battalion mission.

 All Class I (rations) and food items that arrived in Afghanistan for Operation Enduring Freedom IV were coordinated through the Joint Logistics Command in Bagram by the food service technician assigned to the 10th FSB. Requisitions were sent to the prime vendor in Bahrain and arrived about six weeks later. All items traveled across the Arabian Sea to the port of Karachi, Pakistan, and then went forward via "Jingle Truck" to Kandahar because there was no reinforcing US Army unit available for this task. Fresh fruits and vegetables were normally delivered twice a week by chartered aircraft to reduce food spoilage. The Class I section would then conduct a ration break for Soldiers stationed in Kandahar and those positioned forward at

various fire bases. After five months of operation, government contractors augmented the 10th FSB. The Class I mission then was staffed by government contract personnel, allowing the 10th FSB to focus more on its tactical mission.

Water

The 10th FSB deployed with four Reverse Osmosis Water Purification Units (ROWPUs) and an augmentation of 92W (Water Treatment Specialist) Quartermasters and leaders from the MSB. Of these four ROWPUs, two remained in Kandahar and two were deployed forward to support operations away from the main area of concentration. Water consumption was very high. Water from the ROWPUs primarily was used in the showers of the Force Provider tent cities and in cooking and commercial laundry facilities. Procured by contract, bottled water was the greatest of all force multipliers during Enduring Freedom IV. Water procured regionally was purchased only if it met specific guidelines and requirements established by the Department of the Army. All water used during Operation Enduring Freedom IV by US military, coalition forces and contractors, regardless of distribution method, was tested routinely by Task Force Preventive Medical personnel.

Supply Support Activity (SSA), Multicommodity Warehouse Operations for Supply Classes II (general supplies), IV (construction and barrier materiel), VII (major end items) and IX (repair parts)

The SSA was the largest and busiest operation for the 10th FSB. During an average week, the 92A Quartermasters received and processed more than 99 pallets of various classes of durable, expendable, nonexpendable supplies and repair parts and also handled all incoming contract air shipments from direct vendor purchases. This operation performed wholesale and retail logistics operations, and all accountable officer functions associated with making the operations efficient. Document processing time was reduced to hours instead of days. By the end of the 10th FSB's deployment to Operation Enduring Freedom IV, this warehouse met and exceeded all Department of the Army standards for receipt processing, line item number (LINs) zero balances, and LIN zero balances with due-outs.

Through Dollar Cost Banding, the Soldiers and leaders who ran this operation saved millions of dollars by retrograding thousands of items back into the Army supply system. These Soldiers handled all incoming supplies for all agencies operating forward to include the US Air Force, US Marines, US Army and US Special Forces. In total, the 10th FSB's Soldiers in the SSA accounted for more than 3,800 LINs of various commodities on a daily basis.

Bulk Class III (petroleum, oils and lubricants or POL)

This was another area that was a nondoctrinal mission for a light FSB. Maybe the better way to sum up the mission with bulk Class III is to say that this was another area requiring some adjustment and immediate training to ensure success. The 10th FSB was augmented once again by the MSB to handle a massive bulk Class III mission. The 10th FSB also was augmented with Soldiers in the US Army Reserve (USAR) from the 877th Quartermaster Company (POL), EI Paso, TX. This augmentation included several 92F (Petroleum Supply Specialist) and 92L (Petroleum Laboratory Specialist) Soldiers in addition to Soldiers from the 10th Mountain DISCOM.

These Soldiers accounted for more than 800,000 gallons of fuel each day. Fuel used in Afghanistan was managed by the Defense Energy Supply Center (DESC) in Bahrain. The fuel

received in Afghanistan was Jet-A fuel refined in Pakistan and then delivered by contract truck to Kandahar where fuel handlers would inject the required additives to convert it to JP-8 fuel. In February 2004, a change of vendors resulted in direct delivery of JP-8 to Kandahar Army Airfield and thus eliminated the need for further fuel conversion. This change was a result of using the Defense Logistics Agency's Fuel Automation System (FAS). As operations and airflow simultaneously increased, the stockage objective increased from 800,000 gallons of JP-8 to more than one million gallons per day.

Class V (ammunition)

The 10th FSB mission began and ended with operating a joint ammunition supply point (ASP) and ammunition holding area (AHA) on an old Soviet-era aircraft storage facility. Doctrine would lead all to believe that FSBs operate ammunition transfer points (ATPs). However, because the 10th FSB was operating from a fixed base, once again its mission became nondoctrinal for any type of FSB. All ammunition for Operation Enduring Freedom IV at Kandahar Army Airfield was shipped by air and then managed, handled and stored by Soldiers from the 10th FSB and a platoon from the 395th Ordnance Company, a USAR unit from Wisconsin, and an ammunition officer attached from 1st COSCOM, Fort Bragg, NC. Ammunition throughout Operation Enduring Freedom IV was in limited supply for certain Department of Defense Identification Codes (DODICs). However, no mission suffered from the inability to properly manage and handle coalition task force ammunition.

Field Services

Mortuary Affairs

The 10th FSB Support Operations Section is authorized a staff sergeant, a 92M (Mortuary Affairs Specialist), to manage and coordinate mortuary affairs for the brigade coalition task force. The 10th FSB deployed with a 92M Quartermaster in the rank of E4 who managed mortuary affairs for the task force. The 10th FSB also was augmented with three Soldiers from the 54th Quartermaster Company, Fort Lee, VA, who actually operated the lOth FSB mortuary affairs site.

Many supported units did not understand their responsibilities for properly handling human remains and inventorying the personal effects of deceased Soldiers. Within three weeks of deployment, the 10th FSB successfully trained all key supply personnel in all task force units on basic unit responsibilities for mortuary affairs. Training included making sure that all units had the updated Army and Combined Joint Operating Area (CJOA) policies for handling deceased Soldiers. During Operation Enduring Freedom IV, 92M Soldiers with the 10th FSB processed the remains of several US Soldiers and civilian contractors, including Afghan nationals.

Aerial Delivery

All rigging of the CDS for Combined Task Force Warrior (l51 Brigade Combat Team) and US Special Forces was handled by a platoon of riggers from the 647th Aerial Delivery Company, Fort Bragg, NC, 1st COSCOM. Although most supplies were delivered via "Jingle Truck" and sling load, the riggers served as the most valuable asset to meet task force contingency and emergency resupply needs throughout the most austere locations in southeastern Afghanistan. The riggers also built hundreds of "kicker pallets" for the delivery of vital supplies by using low-altitude parachute drops from CH-47 helicopters.

Maintenance

Operational readiness for the 10th FSB never fell below 95 percent throughout Operation Enduring Freedom IV. For the brigade coalition task force, it never fell below 94 percent for major equipment and weapons systems. The supply system was the victory of the 10th FSB mechanics maintaining, meeting and exceeding US Army standards for organization and direct support maintenance. Order Ship Time (OST) during Operation Enduring Freedom IV was better than any that most Soldiers had experienced with using the Standard Army Retail Supply System (SARSS) in a tactical or field environment.

Although Afghanistan represents the most austere tactical environment imaginable, the 10th FSB was resourced with supply and maintenance Logistics Assistance Representatives (LARs) from the US Army Materiel Command (AMC) and the US Army Tank-automotive and Armaments Command (TACOM). The 10th FSB also had the luxury of open access to contacting vendors and commodity managers by using direct dial-up telephone connections to speed up the requisition process. Because of this, Customer Wait Time (CWT) for repair parts ranged between 15 and 22 calendar days from request by customer unit to issue for the duration of the operation. The standard Class IX requisitioning process in Afghanistan for Operation Enduring Freedom IV was the Unit Level Logistics System (ULLS) to SARSS "blasting" to 32lst Corps, Theater Automatic Data Processing (ADP) Service Center Forward (CTAS FWD) in Kuwait to 321st CTAS in Baton Rouge, LA. The 10th FSB also had the ability to use item managers from the Joint Logistics Command (JLC), an organization consisting of mostly 10th Mountain DISCOM staff and materiel management personnel who ran split operations in Kandahar and Bagram, Afghanistan, to call in high priority requests for pacing items and other critical combat systems.

Medical

The 10th FSB Medical Company was augmented with personnel from the MSB, the 44th Medical Brigade and the 911th Forward Surgical Team. In essence, "Charlie Med" was masquerading as a combat support hospital forward more so than an FSB's forward medical company. This medical unit was equipped with every function imaginable, and this was directly responsible for saving the lives of many US Soldiers and local civilians.

Fuel, water and ammunition were the most valued commodities to sustain combat operations in southeastern Afghanistan during Operation Enduring Freedom IV. Without a steady and seamless flow of these highly critical resources, the global war on terrorism in this region of the world cannot be won. The following lists provide a "snapshot" of what 10th FSB Soldiers accomplished during the first eight months of Operation Enduring Freedom IV:

Commodity	Weekly Total	Cumulative Total
Class I Issued		
MREs	3,782 cases	49,098 cases
UGRs	1,172 cases	297,704 cases
Water Issued		
Bottled		1,258,332 liters
Bulk	121,870	4,019,388 gallons
Movements		
US Army trucks	162 trucks	1,741 trucks
'Jingle Trucks'	93 trucks	1,859 trucks
Container release point	652 pieces	12,496 pieces
Classes II, III (bulk) IV, VII and IX		
Air lines of communications	99 pallets	1,083 pallets
Retrograde	3 pallets	295 pallets
Maintenance		
Work order received	150	2,878
Work order completed	137	2,828
Production index	.91	.98
Medical Patients		
Human		20,062
Animals		3,248
Mortuary Affairs		50 human remains

When most senior leaders would visit and ask about the 10th FSB's organization, I would state that I really did not know what kind of battalion the 10th FSB was in Afghanistan - but one thing I knew for sure was that we were not the Army's light FSB. Because the 10th FSB mission was so untraditional, I called the 10th an "FSB on steroids." The greatest lesson learned during this deployment was that training is a never-ending process, especially when personnel are being integrated from many different units to form one multifunctional logistics team.

FM 3 (Combat Operations) and FM 4 (Logistics Management) stress what logisticians have to do to help the Soldier achieve success in full spectrum combat operations. These field manuals also discuss situational understanding through having a common operational picture (COP) between the logistics and combat commander in the area of operation and responsibility. All 10th FSB Soldiers and leaders, regardless of rank, found the need for a COP true while supporting combat operations in Afghanistan. Although many junior Soldiers and leaders may not express the Army's new logistics doctrine in these terms, what they did communicate indeed points to the Army's intent in new combat service support (CSS) and operations doctrine.

The 10th FSB redeployed to Fort Drum without reducing the CSS footprint and without working toward being more distribution-based in Afghanistan. However, the military structure, geographical makeup of Afghanistan and force protection measures of this war on terrorism in Southwest Asia did not allow the 10th FSB to do so. The most important truth I will take away from this Operation Enduring Freedom IV is that "Nothing failed due to logistics." The logisticians of the 10th FSB are the epitome of the Quartermaster Ethos "...Soldiers first, technicians second-to-none; battle focused ..."

Chapter 3: Strategic Sustainment to the Warfighter

Section 1:
An 'Opportune Lift' Showcases Joint Logistics Capabilities

Jonathan D. Marcus

Between 1 and 16 March 2004, the Army and the Marine Corps executed a joint ammunition shipping operation aboard the Military Sealift Command's large, medium-speed, roll-on-roll-off ship USNS Soderman. This example of joint cooperation came about after the Army Field Support Command (AFSC) at Rock Island, Illinois, agreed to assist the Marine Corps in an "opportune lift" of ammunition that the Marines wanted moved to Europe. An "opportune lift" is defined by the Department of Defense as that portion of lift capability available for use after planned requirements have been met. At the time, AFSC was in the process of preparing to transport equipment and ammunition for Combat Equipment Group-Afloat (CEG–A), which is a subcommand of AFSC. After a series of conversations among personnel at several different commands, AFSC assisted the Marine Corps in transporting Marine ammunition to Italy aboard the Soderman.

This Army-Marine Corps interservice operation built on joint activities that AFSC has conducted in the past several years, particularly during Operation Enduring Freedom. It allowed AFSC to save the Government money while expediting the shipment of ammunition to the Marine Corps in Europe.

AFSC pre-positions ships throughout the world to transport equipment and ammunition to warfighters in the field as part of the Army Pre-positioned Stocks (APS) Program. CEG–A manages operations connected with APS Afloat. The Soderman is assigned to Theater Flotilla Group III, one of AFSC's groups of pre-positioned vessels.

Ammunition to Europe

On 1 and 2 March, the Soderman was uploaded at Charleston Naval Weapons Station in South Carolina with 17 shipping containers of Marine Corps ammunition. These containers held approximately 6,000 155-millimeter artillery projectiles and were stored on the ship alongside Army ammunition. At the port, CEG–A personnel monitored the upload of the containers onto the Soderman.

The Soderman departed Charleston Naval Weapons Station on 3 March and arrived at Talamone, Italy, on 16 March. A contract group of Italian longshoremen offloaded the ship over 2 days. The ammunition then was taken by schooner through the Navacelli Canal to Camp Darby, Italy, for temporary storage with additional ammunition assets coming from elsewhere in Europe. The Marine Corps ammunition and the other stocks eventually will become part of the War Reserve Stocks for Allies program and will be shipped to another host nation. After the Soderman was downloaded and emptied of ammunition, it continued on its mission to upload equipment at Combat Equipment Battalion-Livorno in Italy.

Joint Service Coordination

The mission's success depended in large part on the expertise and collaborative efforts of individuals who knew how to work within both the Army and Marine Corps logistics systems. Because the mission was outside the normal logistics chain, it required communication and coordination among individuals associated with Army war reserves at AFSC, the Joint Munitions Command, CEG–A, the Army Materiel Command (AMC), and the Marine Corps.

Dave Lakeman, a quality assurance specialist (ammunition surveillance) with AFSC, observed—

> How did the Marine Corps know how to coordinate the activities from individuals at all these organizations, much less know the ship was coming? They didn't. It was individuals who were working war reserves that knew the Marine Corps needed these assets. They used their initiative and said, "Hey, we have an idea. We have a ship coming this way, so let's see if we can expedite the process and see if it is feasible."

The director of ammunition operations at Combat Equipment Battalion-Livorno contacted an ammunition officer at Headquarters, U.S. Marine Corps Forces, Europe, who gained approval for the operation from Marine Corps leaders and War Reserve Stocks for Allies managers. Approval also was obtained from Combat Equipment Group-Europe and Combat Equipment Battalion-Livorno. The Marine ammunition officer also communicated with a logistics management specialist at AMC, who coordinated with the AFSC headquarters to work out the details of the actual shipping.

Under the usual procedures, the Marine Corps ammunition would have been placed on a regular list of items that needed to be shipped to Europe. The Military Sealift Command then would have determined which ships it had available during the requested timeframe to move the ammunition from the United States to Europe. The Military Sealift Command generally has rotating shipments from the United States to Europe designated for certain times of the year. It consolidates ammunition for shipment and distributes it from a designated location in Europe. Executing a joint operation with AFSC produced a huge cost savings for the Marine Corps.

A willingness to assist another service was important to the mission's success. A precedent for the Soderman operation occurred several years ago, when the Marine Corps assisted AFSC in moving some ammunition out of Norway. The Marine Corps had a ship coming into Norway to take Marine assets out. They consented to take along Army assets that AFSC needed to transport from Norway. The Soderman operation thus was another good example of one service helping out another.

Significant Cost Savings

The Soderman joint shipping operation saved the Marine Corps approximately $1.2 million. The Marine Corps also saved about $500,000 in handling and storage fees because the Army already had requisitioned and paid for the ship.

The Marines also will benefit from another cost saving when their ammunition is shipped to its final destination. Just as the opportune lift from the United States resulted in transportation cost savings, attaching the Marine Corps ammunition to the ammunition shipment going from Italy to its final destination will produce a second cost saving.

Much effort is devoted to consolidating cargo shipments when possible. AFSC and AMC personnel contact transportation personnel at the Military Surface Deployment and Distribution Command at Fort Eustis, Virginia, who then provide information to the Military Sealift Command on the shipment. AFSC and AMC ask the two transportation commands if another shipper already is scheduled to transport a shipment at the same time they want to move assets.

Moving ammunition presents special challenges. According to Paul Gebhardtsbauer, an AMC logistics management specialist—

> For general cargo, the bill for shipping is split and you pay for the space used. But ammunition presents a hazard not found in most other commodities. When ammunition is shipped, it is always shipped from places where the risk that's presented is minimum to those people involved in the operation. The ship can't go and dock anywhere except another port that is currently licensed to accept the munitions.

Logistics Transformation

The Soderman operation was an example of successful joint service coordination and cooperation. It also provided a snapshot of the current state of joint global logistics support within AFSC and throughout the Army and the Department of Defense. The process involved in bringing together all of the elements to make this operation successful was complex and somewhat fortuitous.

The future path in military logistics support has been described in recent Army Transformation documents and joint doctrine. These sources include Joint Vision 2020; the 2003 Army Transformation Roadmap; Joint Publication 4–0, Logistics; and leading reports in commercial publications. They describe the evolution of many new ideas in logistics, including Focused Logistics, a global logistics command, the Global Combat Support System, and information fusion that will link Defense logisticians throughout the world to a joint logistics common operating picture.

The ability to "focus" logistics packages and anticipate needs will lead to a more methodical and precise delivery of equipment, materials, and ammunition to warfighters in the field and will prove vital in supporting a campaign-quality Army with a joint and expeditionary mindset. Patrick Monahan, a strategic planning officer at AFSC, notes, "Supporting the joint and expeditionary mindset requires a change of perspective—anticipating the foxhole requirements, satisfying them and not trying to make the industrial base make the foxhole accommodate us. We're trying to satisfy all their requirements by changing here."

Achieving a joint logistics common operating picture depends on information fusion—connecting logisticians to each other in support of the regional combatant commanders. When a joint common operating picture allows the global support structure to be synchronized with the regional combatant commanders, operations like the Soderman mission will be easier to identify and anticipate. A network enterprise with collaborative information systems will make such a coordination effort more automated and more visible. Logisticians will be able to see, anticipate, leverage, and synchronize information and make decisions accordingly. As logistics connectivity becomes routine, operations like the Soderman operation will become more methodical and less the result of chance happenings.

Currently, logistics modernization is linking many systems on the distribution side, and the Joint Forces Command is putting collaborative information in databases for joint services. As Deborah Newman, a strategic planning officer at AFSC, describes it—

> It is not just a matter of moving around blocks on an organizational structure. It is taking systems that exist today and taking the seams out of those systems. And it's putting available information into collaborative information systems that provide the tools that you need to have the visibility all the way from factory to foxhole to see things, anticipate things, do the necessary coordination, and in a more automated manner than what we're doing today. But the types of things that we have accomplished with the Soderman operation are going to be done under a global logistics command. You're still going to have people, and you're still going to have coordination.

While Army logistics is in the midst of rapid transformation, AFSC continues to provide the best possible Department of Defense and interagency support.

Section 2:
Military Prepositioning Observations on Army and Marine Corps Programs During Operation Iraqi Freedom and Beyond

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Highlights

Highlights of GAO-04-562T, a testimony before the Subcommittee on Readiness, Committee on Armed Services, House of Representatives.

Why GAO Did This Study

Since the Cold War, the Department of Defense (DOD) has increased its reliance on prepositioned stocks of military equipment and supplies, primarily because it can no longer plan on having a large forward troop presence. Prepositioned stocks are stored on ships and on land in the Persian Gulf and other regions around the world. Prepositioning allows the military to respond rapidly to conflicts. Ideally, units need only to bring troops and a small amount of materiel to the conflict area. Once there, troops can draw on prepositioned equipment and supplies, and then move quickly into combat.

Today's testimony describes (1) the performance and availability of Army and Marine Corps prepositioned equipment and supplies to support Operation Iraqi Freedom (OIF); (2) current status of the stocks and plans to reconstitute them; and (3) key issues facing the military as it reshapes these programs to support DOD's force transformation efforts.

GAO's observations are based on ongoing work as well as previous reports on equipment accountability, supply distribution, and other logistics issues during OIF, plus other past work on spare parts shortages and on the readiness of prepositioning programs.

What GAO Found

The importance of prepositioned stocks was dramatically illustrated during OIF. While they faced some challenges, the Army and Marine Corps relied heavily on prepositioned combat equipment and supplies to decisively defeat the Iraqi military. They both reported that prepositioned stocks were a key factor in the success of OIF. Prepositioned stocks provided most of the combat equipment used and, for the most part, this equipment was in good condition and maintained high readiness rates. However, the Army's prepositioned equipment included some older models of equipment and shortfalls in support equipment such as trucks, spare parts, and other supplies. Moreover, the warfighter did not always know what prepositioned stocks were available in theater, apparently worsening an already overwhelmed supply-and-distribution system. The units were able to overcome these challenges; fortunately, the long time available to build up forces allowed units to fill many of the shortages and adjust to unfamiliar equipment.

Much of the prepositioned equipment is still being used to support continuing operations in Iraq. It will be several years—depending on how long Iraqi Freedom operations continue—before these stocks will be available to return to prepositioning programs. And, even after they become available, much of the equipment will likely require substantial maintenance, or may be worn out beyond repair. The Army has estimated that it has an unfunded requirement of over $1 billion for reconstituting the prepositioned equipment used in OIF. However, since most prepositioned equipment is still in Southwest Asia and has not been turned back to the Army Materiel Command for reconstitution, most of the funding is not required at this time. When the prepositioned equipment is no longer needed in theater, decisions will have to be made about what equipment can be repaired by combat units, what equipment must go to depot, and what equipment must be replaced with existing or new equipment to enable the Army to reconstitute the prepositioned sets that were downloaded for OIF.

DOD faces many issues as it rebuilds its prepositioning program and makes plans for how such stocks fit into its future. In the near term, the Army and Marines must necessarily focus on supporting ongoing OIF operations. While waiting to reconstitute its program, the Army also has an opportunity to address shortfalls and modernize remaining stocks. For the longer term, DOD may need to (1) determine the role of prepositioning in light of efforts to transform the military; (2) establish sound prepositioning requirements that support joint expeditionary forces; and (3) ensure that the program is resourced commensurate with its priority and is affordable even as the force is transformed. Congress will play a key role in reviewing DOD's assessment of the cost effectiveness of various options to support its overall mission, including prepositioning and other alternatives for projecting forces quickly.

Mr. Chairman and Members of the Subcommittee:

> Thank you for the opportunity to discuss our work on logistical issues related to Operation Iraqi Freedom (OIF), focusing on prepositioned stocks. Since the end of the Cold War, the Department of Defense (DOD) has increased its reliance on prepositioned reserves of military equipment and supplies since it can no longer plan on having a large forward troop presence. Prepositioned stocks are stored on ships and on land in the Persian Gulf and other regions around the world. Prepositioning can speed response times. Ideally, the military needs only to bring troops and a small amount of materiel to the area of conflict. Once there, troops can draw on prepositioned equipment and supplies, and then move rapidly into combat.

> My statement today reflects our preliminary observations drawn from ongoing work as well as previously published reports. As requested, my testimony today will focus on the performance, reconstitution, and future of prepositioning programs. Specifically, it describes (1) the performance and availability of Army and Marine Corps prepositioned equipment and supplies to support OIF; (2) the current status of the stocks and plans to reconstitute them; and (3) key issues facing the military as it reshapes these programs to support the military's force transformation efforts.

Summary

The importance of prepositioned stocks was dramatically illustrated during OIF. While they faced some challenges, the Army and Marine Corps relied heavily on prepositioned combat equipment and supplies to decisively defeat the Iraqi military. The following summarizes our preliminary observations and issues to consider for the future.

- Army and Marine Corps officials reported that prepositioned stocks were a key factor in the success of OIF. Prepositioned stocks provided a significant amount of the combat equipment used by the Army and the Marine Corps. For the most part, the prepositioned combat systems were in good condition and reportedly maintained high readiness rates throughout the war. However, the Army's prepositioning program had some less-than-modern equipment and had shortfalls, such as trucks, spare parts, and other items. Moreover, the warfighters did not always know what prepositioned sustainment stocks were available in theater, apparently worsening an already overwhelmed theater supply-and distribution system. While these challenges were not insurmountable to the units, they did slow them down. Fortunately, the long time available to build up forces allowed U.S. forces to fill many of the shortages and adjust to unfamiliar equipment.

- Much of the prepositioned equipment is still being used to support continuing operations in Iraq. It will be several years—depending on how long Iraqi Freedom operations continue—before these stocks will be available to return to prepositioning programs. And, even after these stocks become available, much of the equipment will likely require substantial maintenance, or it may be worn out beyond repair. The Army has estimated that it has an unfunded requirement of over $1 billion for reconstituting the prepositioned equipment used in OIF. However, since most prepositioned equipment is still in Southwest Asia and has not been turned back to the Army Materiel Command for reconstitution, most of the funding is not required at this time. When the prepositioned equipment is no longer needed in theater, decisions will have to be made about what equipment can be repaired by combat units, what equipment must go to depot, and what equipment must be replaced with existing or new equipment to enable the Army to reconstitute the prepositioned sets that were downloaded for OIF. In the interim, both the Army and Marines have kept some land- or sea-based prepositioned stocks in the Pacific to cover a possible contingency in that region.

- The defense department faces many issues as it rebuilds its prepositioning program and makes plans for how such stocks fit into the future. In the near term, the Army and the Marine Corps must necessarily focus on supporting ongoing operations in OIF. And while it may be several years before most prepositioned assets are available to fully reconstitute the Army's programs, opportunities exist to address shortfalls and selectively modernize the remaining stocks. For the longer term, the department may need to rethink its prepositioning programs to ensure that they are in sync with overall transformation goals and the evolving military strategy. Some changes are already underway. For example, the Army and Marine Corps are pursuing sea-basing ideas—where prepositioning ships could serve as floating logistics bases. Importantly, DOD needs to consider affordability. The drawdown of Army forces made prepositioning a practical alternative in recent years because the service had ample equipment. However, as the services' equipment is transformed or recapitalized, it may not be practical to buy enough equipment for units to have one set at their home station and another set in prepositioning. Consideration of the cost of various options will be critical as the department evaluates alternatives for transforming its force structure to achieve future mission objectives. Congress will have a key role in reviewing the department's assessment of the cost-effectiveness of options to support DOD's overall mission, including mobility and force projection.

In responding to your request, we conducted work that included officials from Headquarters, U.S. Army and U.S. Marine Corps, Washington, D.C.; Army Field Support Command, Rock Island, Illinois; Combat Equipment Group-Afloat, Goose Creek, South Carolina; and Blount Island Command, Jacksonville, Florida. At these locations, we interviewed officials familiar with prepositioning issues during OIF as well as plans for the future. We reviewed and obtained relevant documentation and performed analyses of reconstitution and options for the future. We also reviewed after-action reports on OIF and Operation Desert Storm. We obtained service estimates for funding prepositioned stocks requirements, but we did not validate these estimates. In addition, we drew on the preliminary results of our ongoing reviews of OIF lessons learned and OIF reconstitution and on our recent reports on OIF supply and distribution issues, Stryker deployment, and Army spare parts shortages. We also relied on our 2001 report on Army war reserve spare parts shortages, 1998 report on prepositioning in the Army and the Air Force, and early 1990s reports on Operation Desert Storm.[1] We performed our work in March 2004 in accordance with generally accepted government auditing standards.

Background

The basic purpose of prepositioning is to allow DOD to field combat-ready forces in days rather than in the weeks it would take if the forces and all necessary equipment and supplies had to be brought from the United States. However, the stocks must be (1) available in sufficient quantities to meet the needs of deploying forces and (2) in good condition. For prepositioning programs, these factors define "readiness." If on-hand stocks are not what is needed—or are in poor condition—the purpose of prepositioning may be defeated because the unit will lose valuable time obtaining or repairing equipment and supplies. U.S forces had months to build up for OIF, so speed was not imperative. Prepositioning sites became reception and staging areas during the months leading up to the war, and afforded the military the necessary time and access in Kuwait to build up its forces for the later offensive operations of OIF.

Prepositioning programs grew in importance to U.S. military strategy after the end of the Cold War, particularly for the Army. Recognizing that it would have fewer forward-stationed ground forces—and to support the two-war strategy of the day—the Army used equipment made available from its drawdown to field new sets of combat equipment ashore in the Persian Gulf and in Korea. It also began an afloat program in the 1990s, using large ships to keep equipment and supplies available to support operations around the world. The Marine Corps has had a prepositioned capability since the 1980s. Its three Marine Expeditionary Forces are each assigned a squadron of ships packed with equipment and supplies—the Marines view this equipment as their "go-to-war" gear. Both the services also have retained some stocks in Europe, although the Army stocks have steadily declined since the end of the Cold War.[2] Today, the Army has sites in the Netherlands, Luxembourg, and Italy, while the Marine Corps retains stocks in Norway. Figure 1 shows the location of Army and Marine Corps prepositioned equipment prior to OIF.
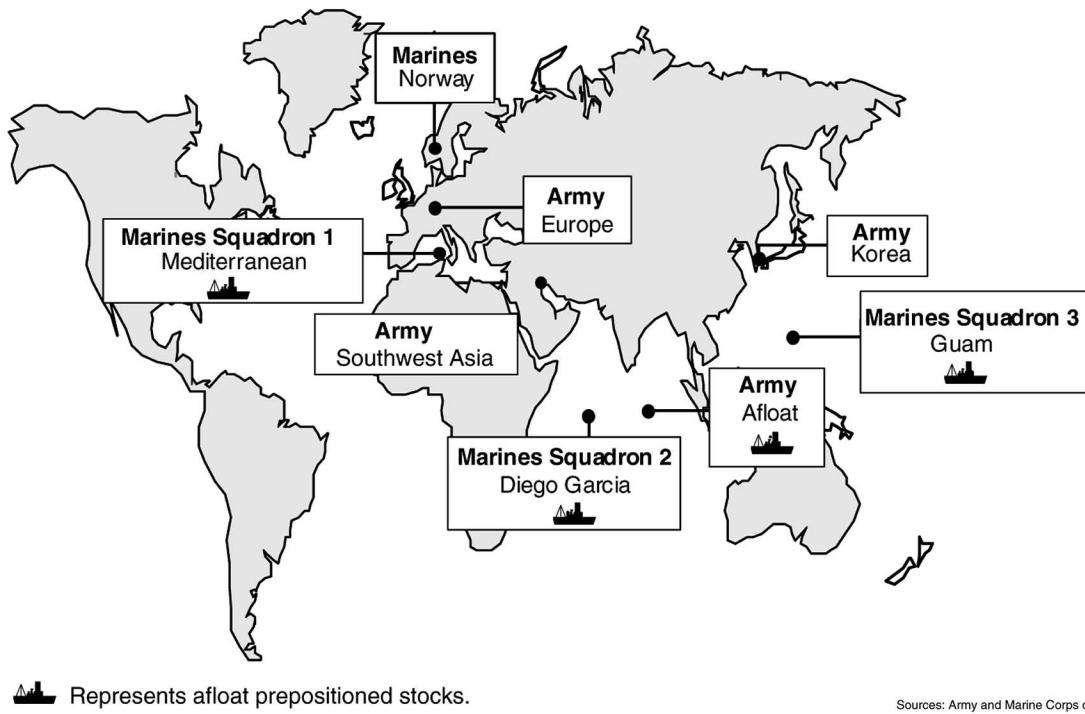
Figure 1: Location of Army and Marine Prepositioned Equipment Prior to OIF

Prepositioning is an important part of DOD's overall strategic mobility calculus. The U.S. military can deliver equipment and supplies in three ways: by air, by sea, or by prepositioning. Each part of this triad has its own advantages and disadvantages. Airlift is fast, but it is expensive to use and impractical for moving all of the material needed for a large-scale deployment. Although ships can carry large loads, they are relatively slow. Prepositioning lessens the strain on expensive airlift and reduces the reliance on relatively slow sealift deliveries. However, prepositioning requires the military to maintain equipment that essentially duplicates what the unit has at home station. Moreover, if the prepositioned equipment stocks are incomplete, the unit may have to bring along so much additional equipment that using it could still strain lift, especially scarce airlift in the early days of a conflict.

Prepositioned Equipment Performed Well in OIF, Despite Shortfalls and Other Logistical Challenges

The Army and Marine Corps reported that their prepositioned equipment performed well during OIF but that some problems emerged. We reviewed lessons-learned reports and talked to Army and Marine Corps officials who managed or used the equipment. We heard general consensus that major combat equipment was generally in good condition when drawn and that it performed well during the conflict. However, Army officials said that some equipment was out-of-date and some critical items like trucks were in short supply and parts and other supplies were sometimes not available. The officials agreed that, overall, OIF demonstrated that prepositioned stocks could successfully support major combat operations.

Most of the issues we heard were with the Army's program. Marine Corps officials reported few shortfalls in their prepositioned stocks or mismatches with unit equipment. This is likely due to two key differences between the services. First, the Marines view prepositioned stocks as their "go-to-war" gear and give the stocks a very high priority for fill and modernization. Second, the units that will use the prepositioned stocks are assigned in advance and the Marine Corps told us that the combat units feel a sense of "ownership" in the equipment. This manifests itself in important ways. For example, the Marines have periodic conferences with all involved parties to work out exactly what their ships will carry and what the units will need to bring with them to the fight. Such an effort to tailor the prepositioned equipment increases familiarity, allows for prewar planning, and thus minimizes surprises or last-minute adjustments. The Marines also train with their gear periodically. By contrast, the Army does not designate the sets for any particular unit and provides little training with the equipment, especially with the afloat stocks.

Prepositioned Combat Equipment Performed Well

Personnel who used and managed the equipment agreed that the tanks, infantry fighting vehicles, and howitzers were in good condition when they were drawn from the prepositioned stocks; moreover, the equipment generally stayed operational throughout the fight. For example, the Third Infantry Division after-action report said that new systems and older systems proved to be very valuable and the tanks and Bradleys were both lethal and survivable. Additionally, according to Army Materiel Command documents, combat personnel reported that their equipment, in many cases, worked better than what they had at home station. Moreover, operational readiness data we reviewed showed that major combat equipment stayed operational, even in heavy combat across hundreds of miles. In fact, officials from both services agreed that OIF validated the prepositioning concept and showed that it can successfully support major combat operations. Moreover, the U.S. Central Command, in an internal lessons-learned effort, concluded that prepositioned stocks "proved their worth and were critical in successfully executing OIF."

Some Prepositioned Equipment Was Out-of-Date or Did Not Match Unit Needs

Some of the Army's prepositioned equipment was outdated or did not match what the units were used to at home station. At times, this required the units to "train down" to older and less-capable equipment or bring their own equipment from home. Examples include:

- **Bradleys**—The prepositioned stocks contained some older Bradley Fighting Vehicles that had not received upgrades installed since Operation Desert Storm. Such improvements included items like laser range finders, Global Positioning System navigation, thermal viewers, battlefield identification systems, and others. In addition, division personnel brought their own Linebacker" Bradleys instead of using the outdated prepositioned stocks that would have required the crew to get out of the vehicle to fire.

- **M113 Personnel Carriers**—The prepositioned stocks contained many older model M113A2 vehicles. This model has difficulty keeping up with Abrams tanks and requires more repairs than the newer model M113A3, which the units had at home station.

- **Trucks**—The prepositioned stocks included 1960s-vintage model trucks that had manual transmissions and were more difficult to repair. Most units now use newer

models that have automatic transmissions. The effect of this was that soldiers had to learn to drive stick shifts when they could have been performing other tasks needed to prepare for war; in addition, maintenance personnel were unfamiliar with fixing manual transmissions.

- **Tank Recovery Vehicle**—The prepositioned stocks contained M-88A1 recovery vehicles. These vehicles have long been known to lack sufficient power, speed, and reliability. We reported similar issues after Operation Desert Storm.[3] According to data collected by the Army Materiel Command, these vehicles broke down frequently, generally could not keep up with the fast-paced operations, and did not have the needed capabilities None of these problems, however, were insurmountable. The U.S. forces had months to prepare for OIF, and plenty of time to adjust to the equipment they had available. Additionally, the U.S. forces faced an adversary whose military proved much less capable than U.S. forces. even when they were in operation.

Army Faced Spare Parts Shortfalls and Theater Distribution Issues

Our preliminary work also identified shortfalls in available spare parts and major problems with the theater distribution system, which were influenced by shortages of trucks and material handling equipment. Prior to OIF, the Army had significant shortages in its prepositioned stocks, especially in spare parts. This is a long-standing problem. We reported in 2001 that the status of the Army's prepositioned stocks and war reserves was of strategic concern because of shortages in spare parts.[4] At that time the Army had on hand about 35 percent of its stated requirements of prepositioned spare parts and had about a $1-billion shortfall in required spare parts for war reserves.

Table 1 shows the percentage of authorized parts that were available in March 2001 in the prepositioned stocks that were later used in OIF. These stocks represent a 15-day supply of spare and repair parts for brigade units (Prescribed Load List) and for the forward support battalion that backs up the brigade unit stocks (Authorized Stockage List). While the goal for these stocks was to be filled to 100 percent, according to Army officials the Army has not had sufficient funds to fill out the stocks. In March 2002, the Army staff directed that immediate measures be taken to fix the shortages and provided $25 million to support this effort. The requirements for needed spare and repair parts were to be filled to the extent possible by taking stocks from the peacetime inventory or, if unavailable there, from new procurement.

Table 1: Status of Army Unit Spare Parts Available In Afloat and Selected Land-Based Prepositioned Sets In March 2001[a]

Location	Unit type	Type of spare parts	Percent fill of authorization
Afloat	Brigade set	ASL	63
		PLL	60
	Corps Support	ASL	0
		PLL	30
	Theater Support 1	ASL	18
		PLL	15
	Theater Support 2	ASL	0
		PLL	6
Qatar	Brigade set	ASL	13
		PLL	19
	Division base	ASL	0
		PLL	0

Legend: ASL= Authorized Stockage List, PLL=Prescribed Load List

Source: Army Materiel Command.

[a]Information is provided for prepositioned sets later used in OIF that were managed by the Army Materiel Command. Army Central Command managed the Kuwait set.

By the time the war started in March of 2003, the fill rate had been substantially improved but significant shortages remained. The warfighter still lacked critical, high-value replacement parts like engines and transmissions. These items were not available in the supply system and could not be acquired in time. Shortages in spare and repair parts have been a systemic problem in the Army over the past few years. Our recent reports on Army spares discussed this issue[5] and, as previously noted, our 2001 report highlighted problems specifically with prepositioned spares. According to Army officials, the fill rates for prepositioned spare parts—especially high-value spares—were purposely kept down because of system-wide shortfalls. The Army's plan to mitigate this known risk was to have the units using the prepositioned sets to bring their own high-value spare parts in addition to obtaining spare parts from non-deploying units.

Nonetheless, according to the Third Infantry Division OIF after-action report, spare parts shortages were a problem and there were also other shortfalls. In fact, basic loads of food and water, fuel, construction materials, and ammunition were also insufficient to meet the unit sustainment requirements.

The combatant commander had built up the OIF force over a period of months, departing from doctrinal plans to have receiving units in theater to receive the stocks. When it came time to bring in the backup supplies, over 3,000 containers were download from the sustainment ships, which contained the required classes of supply—food, fuel, and spare parts, among others. The theater supply-and-distribution system became overwhelmed. The situation was worsened by the inability to track assets available in theater, which meant that the warfighter did not know what was available. The Third Infantry Division OIF after-action report noted that some items were flown in from Europe or Fort Stewart because they were not available on the local market. Taken together, all these factors contributed to a situation that one Army after-action report bluntly described as "chaos."

Our recent report on logistics activities in OIF described a theater distribution capability that was insufficient and ineffective in managing and transporting the large amount of supplies and equipment during OIF.[6] For example, the distribution of supplies to forward units was delayed because adequate transportation assets, such as cargo trucks and materiel handling equipment, were not available within the theater of operations. The distribution of supplies was also delayed because cargo arriving in shipping containers and pallets had to be separated and repackaged several times for delivery to multiple units in different locations. In addition, DOD's lack of an effective process for prioritizing cargo for delivery precluded the effective use of scarce theater transportation assets. Finally, one of the major causes of distribution problems during OIF was that most Army and Marine Corps logistics personnel and equipment did not deploy to the theater until after combat troops arrived, and in fact, most Army personnel did not arrive until after major combat operations were underway.

Continuing Support of Operations Will Likely Delay Reconstitution

Forces are being rotated to relieve personnel in theater. Instead of bringing their own equipment, these troops are continuing to use prepositioned stocks. Thus, it may be several years—depending on how long the Iraqi operations continue—before these stocks can be reconstituted.

The Marine Corps used two of its three prepositioned squadrons (11 of 16 ships) to support OIF. As the Marines withdrew, they repaired some equipment in theater but sent much of it back to their maintenance facility in Blount Island, Florida. By late 2003, the Marine Corps had one of the two squadrons reconstituted through an abbreviated maintenance cycle, and sent back to sea.[7] However, to support ongoing operations in Iraq, the Marine Corps sent equipment for one squadron back to Iraq, where it is expected to remain for all or most of 2004. The Marine Corps is currently performing maintenance on the second squadron of equipment that was used during OIF, and this work is scheduled to be completed in 2005.

Most of the equipment that the Army used for OIF is still in use or is being held in theater in the event it may be needed in the future. The Army used nearly all of its prepositioned ship stocks and its ashore stocks in Kuwait and Qatar, as well as drawing some stocks from Europe. In total, this included more than 10,000 pieces of rolling stock, 670,000 repair parts, 3,000 containers, and thousands of additional pieces of other equipment. According to Army officials, the Army is repairing this equipment in theater and reissuing it piece-by-piece to support ongoing operations. Thus far, the Army has reissued more than 11,000 pieces of equipment, and it envisions that it will have to issue more of its remaining equipment to support future operations. Thus, it may be 2006 or later before this equipment becomes available to be reconstituted to refill the prepositioned stocks. Officials also told us that, after having been in use for years in harsh desert conditions, much of the equipment would likely require substantial maintenance and some will be worn out beyond repair. Figure 2 shows OIF trucks needing repair.

Figure 2: Some Trucks Used in OIF that Need Repair

Both the Army and the Marine Corps have retained prepositioned stocks in the Pacific to cover a possible contingency in that region. While the Marine Corps used two of its three squadrons in OIF, it left the other squadron afloat near Guam. The Army used most of its ship stocks for OIF, but it still has a brigade set available in Korea and one combat ship is on station to support a potential conflict in Korea, although it is only partially filled. Both the Army and the Marine Corps used stocks from Europe to support OIF. The current status of the services' prepositioned sets is discussed in table 2.

Table 2: Current Status of Selected Prepositioning Programs (as of March 2004)

	Location	Status
Army	Kuwait and Qatar	The equipment and supplies from these locations are still in use to support continuing operations in Iraq.
	Korea	This brigade set of equipment is currently filled to approximately 90 percent.
	Afloat	Equipment and supplies from 10 of 11 ships were downloaded to support OIF and most of this equipment remains in Iraq or Kuwait. One combat ship has been partially filled to support two Army battalions. One ammunition ship remains on station and another is in its maintenance cycle. The Army is also working to reconstitute equipment for a support ship and another combat ship, but it is unclear how much equipment will be available to source these requirements.
	Europe	Stocks in Luxembourg, the Netherlands, and Italy have been depleted to support ongoing operations.
Marines	Afloat (Guam)	This 6-ship squadron was not used in OIF and has almost its full complement of stocks.
	Afloat (Mediterranean)	One ship has been downloaded in support of OIF and another has been partially downloaded. This squadron's equipment is currently filled to about half of its requirement and will complete its normal maintenance cycle in 2005.
	Afloat (Diego Garcia)	This squadron's equipment was used during the first phase of OIF, was repaired to combat condition but not to normal standards, and has been downloaded for reuse in Iraq.
	Norway	Stocks in Norway were used to support OIF. Currently, the stocks have approximately two-thirds of the authorized equipment.

Source: U.S. Army and U.S. Marine Corps data.

Army and Marine Corps maintenance officials told us that it is difficult to reliably estimate the costs of reconstituting the equipment because so much of it is still in use. As a result, the reconstitution timeline is unclear. Based on past experience, it is reasonable to expect that the harsh desert environment in the Persian Gulf region will exact a heavy toll on the equipment. For example, we reported in 1993 that equipment returned from Operation Desert Storm was in much worse shape than expected because of exposure for lengthy periods to harsh desert conditions. The Army has estimated that the cost for reconstituting its prepositioned equipment assets is about $1.7 billion for depot maintenance, unit level maintenance, and procurement of required parts and supplies. A request for about $700 million was included in the fiscal year 2004 Global War on Terrorism supplemental budget, leaving a projected shortfall of about $1 billion. Army Materiel Command officials said they have thus far received only a small part of the amount funded in the 2004 supplemental for reconstitution of the prepositioned equipment, but they noted that not much equipment has been available. Additionally, continuing operations in Iraq have been consuming much of the Army's supplemental funding intended for reconstitution. Since much of the equipment is still in Southwest Asia, it is unclear how much reconstitution funding for its prepositioned equipment the Army can use in fiscal year 2005. But it is clear that there is a significant bill that will have to be paid for reconstitution of Army prepositioned stocks at some point in the future, if the Army intends to reconfigure the afloat and land-based prepositioned sets that have been used in OIF.

Issues Facing the Prepositioning Program

The defense department faces many issues as it rebuilds its prepositioning program and makes plans for how such stocks fit into the transformed military. In the near term, the Army and the Marine Corps must focus on supporting current operations and reconstituting their prepositioning sets. Moreover, we believe that the Army may be able to take some actions to address the shortfalls and other problems it experienced during OIF. In the long term, however, DOD faces fundamental issues as it plans the future of its prepositioning programs.

Near-Term Issues

As it reconstitutes its program, the Army would likely benefit from addressing the issues brought to light during OIF, giving priority to actions that would address long-standing problems, mitigate near-term risk, and shore up readiness in key parts of its prepositioning program. These include:

- ensuring that it has adequate equipment and spare parts and sustainment supplies in its prepositioning programs, giving priority to afloat and Korea stocks;

- selectively modernizing equipment so that it will match unit equipment and better meet operational needs; and

- planning and conducting training to practice drawing and using prepositioned stocks, especially afloat stocks.

Based on some contrasts in the experiences between the Army and the Marine Corps with their prepositioned equipment and supplies in OIF, some officials we spoke to agree that establishing a closer relationship between operational units and the prepositioned stocks they would be expected to use in a contingency is critical to wartime success. The Marines practice with their stocks and the Army could benefit from training on how to unload, prepare, and support prepositioned stocks, particularly afloat stocks. While the Army has had some exercises using its land-based equipment in Kuwait and Korea, it has not recently conducted a training exercise to practice unloading its afloat assets. According to Army officials, such exercises have been scheduled over the past few years, but were cancelled due to lack of funding.

Long-term Issues

The long-term issues transcend the Army and Marines, and demand a coordinated effort by the department. In our view, three main areas should guide the effort.

- **Determine the role of prepositioning in light of the efforts to transform the military.** Perhaps it is time for DOD to go back to the drawing board and ask: what is the military trying to achieve with these stocks and how do they fit into future operational plans? If, as indicated in Desert Storm and OIF, prepositioning is to continue to play an important part in meeting future military commitments, priority is needed for prepositioning as a part of transformation planning in the future.

- **Establish sound prepositioning requirements that support joint expeditionary forces.** If DOD decides that prepositioning is to continue to play an important role in supporting future combat operations, establishing sound requirements that are fully integrated is critical. The department is beginning to rethink what capabilities could be needed. For example, the Army and Marines are pursuing sea-basing ideas— where prepositioning ships could serve as offshore logistics bases. Such ideas seem to have merit, but are still in the conceptual phases, and it is not clear to what extent the concepts are being approached to maximize potential for joint operations. In our view, options will be needed to find ways to cost-effectively integrate repositioning requirements into the transforming DOD force structure requirements. For example, Rand recently published a report suggesting that the military consider prepositioning support equipment to help the Stryker brigade meet deployment timelines.[8] Such support equipment constitutes much of the weight and volume of the brigade, but a

relatively small part of the costs compared to the combat systems. Such an option may be needed, since our recent report revealed that the Army would likely be unable to meet its deployment timelines for the Stryker brigade.[9]

- **Ensure that the program is resourced commensurate with its priority, and is affordable even as the force is transformed.** In our view, DOD must consider affordability. In the past, the drawdown of Army forces made prepositioning a practical alternative because it made extra equipment available. However, as the services' equipment is transformed and recapitalized, it may not be practical to buy enough equipment for units at home station and for prepositioning. Prepositioned stocks are intended to reduce response times and enable forces to meet the demands of the full spectrum of military operations. Once the future role of prepositioning is determined, and program requirements are set, it will be important to give the program proper funding priority. Congress will have a key role in viewing the department's assessment of the cost effectiveness of options to support DOD's overall mission, including prepositioning and other alternatives for projecting forces quickly to the far reaches of the globe.

Mr. Chairman, I hope this information is useful to Congress as it considers DOD's plans and funding requests for reconstituting its prepositioned stocks as well as integrating prepositioning into the department's transformation of its military forces. This concludes my prepared statement. I would be happy to answer any questions that you or the Members of the Subcommittee may have.

Contacts and Acknowledgments

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Endnotes

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Section 3:
Customer Support Representative for DLA's Contingency Support Team

MAJ William T Klaus

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If you don't know about the Defense Logistics Agency (DLA) customer support representative (CSR) program and you're in the supply field, then you're missing out on a terrific resource for improving the flow of supplies to your unit. I found out just how important a CSR is while serving as a CSR for six months during Operation Iraqi Freedom II.

What is a CSR? A CSR is DLA's face on the ground to the warfighter. The CSRs act as ambassadors of sorts, making sure the units they support get the supplies ordered from DLA as well as other services that DLA manages. There are five CSRs in Iraq, one for each major subordinate command.

I was assigned to support the 1st Marine Expeditionary Force (IMEF). I was located with IMEF's main supply base at Al Taqaddum near Fallujah and other assorted Army units in the area. As an Army officer supporting the Marines, I had to learn a whole new language. Familiar unit terms such as FSB (forward support battalion) or CSB (corps support battalion) were replaced with Marine terms such as FSSG (force service support group), CSSB (combat service support battalion) and MAW (Marine air wing). Even the maintenance reports were different. For example, an Army 026 report to the Marines is a Daily Process Report. Although I was supporting a different military service, I was still solving supply problems common to the Army. Those problems ranged from backorders, rejections, frozen stock and lost shipments, to the Defense Reutilization and Marketing Service (DRMS) initiatives and the Prime Vendor Program.

'I had passwords to 10 different automated systems while deployed'

My primary tools during my tour were a laptop computer, an Internet connection and a telephone. To effectively do my job I required access to many web-based systems, most requiring a password. Systems such as WEB Visual Logistics Information Processing System (WEBVLIPS), Web-based Customer Accounts Tracking System (WEBCATS), Global Transportation Network (GTN), Joint Total Asset Visibility (JTAV), Standard Automated Materiel Management System (SAMMS) and the Department of Defense's Internet shopping site (EMALL) are just a few of the systems I used on a daily basis. I had passwords to 10 different automated systems while deployed.

A typical work day would begin by checking and answering my E-mail, attending maintenance meetings, answering customer questions and trying to resolve any issues that came up. I would also research any document number or National Stock Number (NSN) that was a problem for the unit. If I couldn't resolve a problem on my end, I would then contact the item manager for that NSN. Some frequent problems for units were requisitions not making it through the system, finding NSNs for items, long-estimated delivery dates for some backorders, and lost or delayed shipments. Sometimes getting supplies delivered in theater took longer than getting an item from the depot in the continental United States (CONUS) to Kuwait. My biggest frustration was when a unit needed a part, there were none on hand, and the part was not being manufactured anymore. Sometimes there were substitute repair parts, but many times there weren't. This was particularly common for older pieces of equipment.

Being a CSR also meant that I worked alone. I had no staff and the work I was given was my responsibility to complete. With DLA managing more than 90 percent of all items to deployed troops, I would sometimes be very busy. I was not, however, without support. DLA also has a DLA Contingency Support Team (DCST) to support the CSRs. The team consists of a forward commander, an operations officer, multiclass commodity specialist, Class I (rations) commodity specialist, a DRMS operations officer and a Defense Energy Supply Center liaison officer. They were located at the Multi-National Force-Iraq headquarters in Baghdad. DLA also has a dedicated staff in CONUS and other overseas locations ready and willing to help. Many times I would contact the item managers or the emergency supply operations center to receive help resolving issues with repair parts and expediting requisitions. DLA maintains command and control of deployed DLA personnel. DLA personnel in theater are under tactical control of the supported command.

While in Iraq, I also maintained a close working relationship with the Army Materiel Command (AMC) which had a logistics support element at Al Taqaddum. In fact, that is where I lived. DLA arranged for AMC to provide me with living space, a vehicle and, most important, an Internet connection. Services ranged from tank and automotive, communications, fire control and armament to power and switch. AMC also had a supply logistics assistance representative who helped with supplies provided by AMC. It was a great advantage living and working in the same area, because many times we were able to help each other with supply and technical questions on equipment.

Any forward-deployed unit in Iraq that needs DLA support can check with its G4 (Logistics) or with its division materiel management center (DMMC). The G4 and DMMC probably already know of a CSR working in the deployed unit's area of operation. To get out the word at Al Taqaddum, I made business cards on plain paper. These came in handy as I met new customers and also saved me from having to write down my contact information for them.

How to Become a Customer Support Representative

If you want to become a CSR, you first must be assigned to the DLA. The DLA has 448 active duty members and 618 reservists from all branches of the military stationed all around the world. You should be in the rank of captain or major. You must be trained in two, one-week schools. One is Materiel Management Contingency Training (MMCT), and the other is Basic Contingency Operations Training (BCOT). MMCT consists of learning how to analyze logistical problems and how to interrogate automated supply information systems to identify, locate and track military supplies. BCOT training focuses on teamwork and basic combat skills. Mainly a review for military personnel, BCOT is required for two reasons: many civilians deployed overseas have not had this training previously in contingency operations, and various military services do not always teach the same skills.

Once trained as a CSR, a service member can be deployed almost anywhere. DLA has personnel in Kuwait, Iraq, Afghanistan, Kosovo and Uzbekistan and even with the Federal Emergency Management Agency (FEMA). Tours of duty can last from four to six months or longer. By becoming a CSR you will gain a better understanding of the wholesale system while providing logistics support up front on the battlefield.

Chapter 4: Research and Development for the Warfighter

Section 1:
Achieving Army-Marine Corps Logistic Interoperability

Dale E. Houck

An Army Stryker battalion is attached to a Marine expeditionary brigade's regimental combat team, which is being supported by the brigade's logistics forces ashore and at sea. On the fifth day of operations ashore, a Stryker health management system identifies a maintenance problem and automatically initiates a call-for-support message. The Stryker crew uses the platform's embedded interactive electronic technical manual to verify the turbocharger has failed and must be replaced. The platform commander submits the call-for-support message for maintenance, providing necessary information to the Stryker battalion supply and logistics officer by means of Force XXI Battle Command, Brigade-and-Below/Joint Capabilities Release (FBCB2/JCR), an automated information system that facilitates enhanced tactical command and control (C2) and situational awareness through the incorporation of interoperable data standards and messaging methods. The supply and logistics officer analyzes the situation and determines he has neither the parts (meaning the turbocharger) nor qualified maintenance personnel (meaning limited forward maintenance team support attached to the Stryker battalion) to support this problem. He forwards the call-for-support message to the Marine Corps' direct support combat logistics battalion operations officer. At the same time, information is extracted from the variable-message-format call-for-support message to automatically open a service request for maintenance in the Marine Corps' logistics business system, the Global Combat Support System-Marine Corps. The direct support combat logistics battalion operations officer uses GCSS-MC to determine that qualified maintenance personnel are available, but the required part is not. The direct support combat logistics battalion operations officer (located ashore) initiates a requisition for the turbocharger in GCSS-MC and forwards it to the general support combat logistics battalion operations officer (located at sea). The general support operations officer cannot satisfy the requirement and forwards the requisition via GCSS-MC to the sea-base, where the turbocharger is sourced. The reinforced combat logistics regiment manages the distribution of the turbocharger to the direct support combat logistics battalion operations officer, who then ensures the turbocharger and a maintenance contact team are sent to fix the Stryker.

While that scenario is hypothetical, it is typical of the circumstances faced by soldiers and Marines in joint operations. In the scenario, the request for support, initiated as an FBCB2/JCR variable-message-format message, is automatically and seamlessly integrated into the business processes and systems of the supporting service without requiring either service to change its unique processes or systems, demonstrating true joint logistics interoperability. The scenario illustrates how network-enabled technologies could enhance future Army and Marine Corps logistics interoperability and readiness during joint combat operations. Inter-Service obstacles to seamless communications are overcome, and common logistics support is delivered to the operational commander on the battlefield.

Operations Desert Storm, Iraqi Freedom, and Enduring Freedom revealed that joint and Service logistics systems that could not communicate with each other resulted in order fulfillment lag times, redundant ordering, choked supply pipelines, and uncertainty for the warfighter. It was

readily apparent that deployable, integrated technology was necessary to provide responsive, agile, and flexible logistics support to the warfighter. As a result, the Army and Marine Corps have been collaborating to leverage and integrate their logistics capabilities to accomplish missions at the tactical level.

Future Imperatives

Two imperatives needed to ensure operational logistics adaptability are reduced logistics demand and intelligent supply chains, with both enabled by data fusion and science and technology. Operational logistics adaptability translates to decision making in the face of complexity and the ability to share information across the joint force unhindered by distance, terrain, weather, or hostile activity; and intelligent supply chains of the future will require radically advanced data collection, transmission, analysis, and discovery of relationships normally hidden in vast quantities of data scattered throughout multiple global data bases. Reduced logistics demand and intelligent supply chains will require integrated and interoperable logistics systems and processes, providing a near-real-time logistics common operating picture and adhering to common net-centric standards and protocols—necessary for success within a common logistics operating environment.

The future land component will be, by necessity, net-centric and interoperable within the full range of military operations including interagency and coalition partners. The Joint Logistics White Paper (draft version 0.6, June 2009) describes a concept for providing logistics support to a future joint operating force in the 2016-2028 timeframe. It describes three well-documented issues that must be overcome:

- Insufficiently integrated logistics organizations and processes

- Execution issues

- Insufficiently interoperable/integrated C2, logistics management, and financial systems.

The Army-Marine Corps Logistics Interoperability Demonstration (AMLID) is a significant step in addressing several of those issues as it works toward improved Army-Marine logistics capabilities.

A Joint Effort for Interoperability

AMLID project is a joint effort between the Army and Marine Corps, with project management provided by the U.S. Army Logistics Innovation Agency, a field operating agency of the Office of the Deputy Chief of Staff of the Army, G-4. The project's goal is to enable Army-Marine Corps logistics interoperability and joint interdependence by creating the capability to exchange actionable information across Service boundaries needed for joint task force employment. Interoperability—the basic tenet of AMLID—provides a compelling case for obtaining required support for a tactical unit from an attached sister Service, as far forward as possible, to eliminate the requirement to conduct reachback logistics support via stovepiped Service systems.

AMLID will perform information exchanges of platform-generated data between logistics and C2 systems. That will result in a cross-Service fulfillment of a logistics support request; and the sharing of common situational awareness across the joint logistics operating environment, building on both Services' logistics operational architectures. AMLID will provide a useful, near-term practical application of logistics C2 convergence through advanced technology insertion. It

will allow Services to operate using their business systems and practices, but still operate jointly. AMLID seeks to provide rapid inter-Service fulfillment of a common sustainment requirement in time-sensitive situations (i.e., when it is more efficient or effective as a result of one or more factors related to mission, enemy, terrain and weather, troops and support available, or time available). While AMLID will demonstrate information exchanges from the platform level via FBCB2/JCR to another Service's logistics system, its metadata dictionary and data translation standards, defined during development of the initial system interfaces, could support further development of a broader spectrum of system interface software and more extensive net-centric logistics capabilities.

Creating Logistics Synergy

AMLID, a four-phased project, will facilitate direct communication between Army and Marine Corps logistics systems, thereby reducing the logistics demand on C2 systems. The AMLID team will develop the seamless integration of variable-message-format data between tactical C2 and logistics systems from each Service as well as the automated extraction of variable-message-format data from the tactical C2 systems and insertion directly into each Service's logistics systems to automatically open service requests, work orders, and supply requisitions. The team has developed a software interface tool known as the Marine-Army Joint Interoperability Component using a service-oriented architecture approach to bridge the gap between systems and networks. A service-oriented architecture approach provides a framework for organizing and orchestrating application functions/services across system boundaries. Within this framework, MAJIC acts as the translator to enable FBCB2/JCR variable-message-format combat service support messages to be exchanged and accurately interpreted among supporting and supported units.

The AMLID use-case scenarios address likely threat scenarios. The use-case technique is used to capture a system's behavioral requirements generated from requests that are based on scenario-driven threads. Completed in March 2009, AMLID Phase I was a laboratory-based demonstration of interoperable network architecture that tested prototype system interfaces and information exchanges. Scenarios were focused at the tactical echelon and included mission threads for resupply of petroleum, oil, and lubricants; ammunition; logistics situational awareness; and maintenance support. The intent was to simulate logistics calls for support by passing Joint Capabilities Release initiated information to GCSS-MC through an enterprise service bus and to a standard Army management information system (STAMIS). FBCB2/JCR version 1.0 was used to send variable-message-format logistics messages from the Marine Corps to the Army and included situation reports, logistics status reports, and call-for-support messages.

Phase I

The Phase I demonstration, conducted at the Marine Corps GCSS-MC System Integration Lab at Pennsylvania State University's Applied Research Laboratory, successfully demonstrated interoperability between Army and Marine Corps information transmissions via FBCB2/JCR, each Service's logistics systems, and MAJIC. Four different use-cases were evaluated, resulting in a 97-percent success rate for the message transfer/translation process. Phase I—and MAJIC in particular—demonstrated that Army and Marine Corps tactical units can transmit requests for emergency logistics requirements between logistics systems using interpretive software (middleware) to translate the raw data inherent in the variable-message-format requests between the Services.

Phase II

AMLID Phase II is currently under way. It includes a senior leadership live platform demonstration that showcases a network architecture expanded to include C2 and logistics systems and processes up to and including the operational echelon. The demonstration consists of two scenarios—forced-entry operations and decisive land operations—with each scenario incorporating situational awareness threads integrated with related C2 monitoring systems. The forced entry operations scenario will include a use-case and thread for petroleum, oil, and lubricants; ammunition; distribution; and logistics situational awareness, while the decisive land operations scenario will focus on repair parts, maintenance, distribution, and logistics situational awareness. The ability to seamlessly communicate requests for service, feedback, and status information between GCSS-MC and the Army STAMIS/GCSS-Army system is a primary objective. A successful demonstration will provide a valuable assessment on the potential to eventually extend the same capability to Global Combat Support System-Joint.

Phase II—which is designed to successfully pass logistics information between Service logistics systems—will significantly advance the utility of interoperability, resulting in platform-level data aggregated in C2 systems and joint logistics situational awareness. Information will flow between operating combat platforms, a Marine Corps light armored vehicle, and an Army Stryker using FBCB2/JCR—through MAJIC—allowing information to go from one Service to another. Upon completion, AMLID will have developed consolidated mission threads for petroleum, oil, and lubricants; ammunition; and repair parts; as well as distribution in-transit visibility and logistics situational awareness. DoD's Battle Command Sustainment and Support System will be integrated into the overall network architecture in order to manage logistics situational awareness through the various logistics supporting establishments to the theater sustainment command and Joint Task Force component commander.

Successful completion of Phase II will serve as a foundation for prospective follow-on Phases III and IV. AMLID team stakeholders envision Phase III to be the development of a fielding plan for the logistics interoperability functionality that was developed, blueprinted, and demonstrated during Phases I and II. The project would culminate in Phase IV, providing for the advanced integration of AMLID technology into other closely related logistics modernization programs, such as the Marine Corps' Autonomic Logistics effort and the Army's Conditions-Based Maintenance Plus project. While not yet officially sanctioned by Service proponents, those follow-on efforts could potentially support the objectives of the Services' combat service support and sustainment missions and the visions outlined in their higher-level logistics architectures.

Logistics Architectures

AMLID is a major initiative of the Army's Common Logistics Operating Environment Program and is aligned with objectives of the Marine Corps' Logistics Modernization program and Joint Forces Command's Joint Interoperability and Data Dissemination Strategy. The Common Logistics Operating Environment is the Army's capstone initiative to synchronize diverse logistics modernization efforts into a cohesive, net-centric logistics domain. The effort integrates data across the full spectrum of logistics and includes equipment platforms, logistics information systems (including GCSS-Army), and C2 systems—all functioning within a common architectural framework described in detail by the Army's Training and Doctrine Command-validated Army Integrated Logistics Architecture. That architecture spans from the tactical through strategic echelons; supports a joint, integrated environment; and assists the Army logistics community in achieving integration and interoperability in the logistics domain.

The Marines' Logistics Modernization Program will produce a more effective and efficient logistics chain management process, with modernized, integrated, and streamlined supply, maintenance, and distribution processes that conform to the Marine Corps' Logistics Operational Architecture. The architecture supports the implementation of enterprise-wide processes for logistics and will be supported by a thoroughly modernized enterprise resource planning system, GCSS-MC.

Both the Army and the Marine Corps architectures provide the framework to clearly define logistics processes and to implement net-centric warfare principles in the logistics domain. Additionally, they provide the foundation to move beyond the unsynchronized use of a handful of common C2 systems and help realize a unity of effort within the logistics joint capability area.

Architecturally, AMLID supports both the Army's and the Marine Corps' logistics architectures and seeks to provide a flexible support construct that integrates various logistics systems across Service boundaries. It is accelerating the technology maturation process for logistics automation in a joint operational environment. The Phase II demonstration will provide an early opportunity to perform focused testing on the latest version of GCSS-MC's Release 1.1 software and evaluate its prospective future interoperability with the Army's STAMIS. Ultimately, DoD Architecture Framework products developed for AMLID will be fed back to the Marine Corps' Logistics Operational Architecture and the Army Integrated Logistics Architecture to assist in the further development of common data standards and associated architectures that will facilitate logistics net-centricity and fully integrated Army and Marine Corps operations.

A Significant Step

The Army and Marine Corps continue to reduce gaps in logistics interoperability related toorganizational and system interface differences and non-standard architecture. AMLID identifies gaps in process or system interoperability where additional work may be necessary in order to support the development of a composite architecture (the Marine Corps' Logistics Operational Architecture and the Army Integrated Logistics Architecture) necessary for joint interoperability. AMLID's service-oriented architecture allows different applications to exchange data, and tools such as MAJIC will make it possible to securely exchange information between Service enterprise resource planning systems and legacy systems.

AMLID does not purport to be a final solution in resolving interoperability issues between the Army and Marine Corps or other DoD services and supporting government agencies; however, it is the focused application of technology solutions to improve the efficiency of Army-Marine Corps operations as part of a joint force. AMLID is a significant step in achieving:

- More effective and efficient joint logistics

- The coordinated use, synchronization, and sharing of two or more military departments' logistic resources to support the joint force

- A foundation for future programs, such as GCSS-Joint.

As AMLID evolves to support remaining classes of supply, it will integrate disparate Service information systems and data to provide enhanced visibility of resources and requirements; and it will provide Army brigade combat teams and Marine Corps regimental combat team commanders, and ultimately all of DoD, an effective means to achieve mission objectives.

Section 2:
Precision Cargo Air Drop - Coming to Your Servicing Theater

Albin R. Majewski and CPT Arthur A. Pack

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Just a few years ago if you had spoken to personnel from units outside the Airborne and Light Infantry communities about precision air drop resupply, you would have received some mighty strange looks. Today, because of highly dispersed operations, the length of ground lines of communication (GLOC), the enemy's continuous attacks on convoys and increased use of improvised explosive devices (IEDs) in Southwest Asia, the expanded use of cargo air drop resupply doesn't seem so far-fetched. The operational environment has caused the Army to rethink the way to sustain the warfighter and to accelerate delivery of a precision air drop capability, in support of Operation Iraqi Freedom.

Urgent Operational Need

Off-the-shelf technology called the Sherpa 900 system was the immediate answer to an urgent request from Multi-National Force-Iraq for extra-light air drops to Marines in forward operating bases. The Sherpa 900 gets its name not because of its 1,200-pound load weight, but because of its 900-square-foot RAM air parachute canopy that can be steered - unlike the standard round canopy. The Sherpa drops since last August typically have been Meals, Ready to Eat and bottled water delivered within 100 meters of the predetermined impact point in remote locations.

The Directorate of Combat Developments for Quartermaster (DCD-QM), US Army Combined Arms Support Command, has been playing an active role in securing advanced technology for precision air drop since approval of a mission needs statement in 1997. However, the initiative gained visibility in October 2002 when the Deputy Commanding General, US Army Quartermaster Center and School, decided for DCD-QM to pursue precision air drop as an official Advanced Concept Technology Demonstration (ACTD). At the same time, the Army Natick Soldier Center was developing a linkage between the Air Force's Precision Air Drop System (PADS) and the Army's Precision Extended Glide Airdrop System (PEGASYS). Together, the Army and Air Force pursued an ACTD for their linked programs, named the Joint Precision Air Drop System (JPADS). The go-ahead for the JPADS ACTD came in August 2003.

What is an ACTD and why is it so important? ACTDs emphasize technology assessment and integration rather than technology development to solve important military problems. The ACTD's goals are to provide warfighters a prototype of a capability and to support the Soldiers evaluating that prototype. Warfighters evaluate technologies in real military exercises. Also, a key ACTDs objective is to provide an operational capability to the warfighter as an interim solution before procurement of a successful prototype.

The assessment of the Sherpa 900 system for extra-light precision air drop in Iraq became an interim solution while the JPADS ACTD's process worked toward the demonstration of a 10,000-pound total rigged weight capability and a 2,200-pound total rigged weight capability. The Sherpa 900 system's 1,200-pound load weight met a more immediate need for combat operations.

In May 2004, the Army G3 (Operations) approved an Urgent Operational Needs Statement initiated by Multi-National Force-Iraq, requesting an extra-light precision air drop capability in the theater of operations during FY04. The system's users would be Marines - in particular the riggers from 1st Air Delivery Platoon that is part of Combat Service Support Battalion 7, 1st Force Service Support Group delivering supplies to Marine units throughout the vast western portion of Iraq's Al Anbar Province. After completing coordination, Marines from the Marine detachment in theater and from their home base at Camp Pendleton, CA, completed Sherpa 900 training at Yuma Proving Ground, AZ.

The Sherpa 900 system consists of a mission planner, central processing unit (CPU), parachute control unit (PCU) with built-in Global Positioning System (GPS) guidance unit, and the 900-square-foot canopy. By contrast, the Army/Air Force JPADS with a 10,000-pound total rigged weight is considered the light version in the JPADS family of systems under development. The extra-light version of JPADS has a total rigged capability of 2,200 pounds. The Sherpa 900 is considered a 60 percent solution to what is to come. The final solution will be incorporated with the Air Force's PADS capability and then boosted to a total rigged weight of 2,200 pounds.

Battle Hand-Off During Operation Iraqi Freedom

After the Marines completed training in Arizona, two Sherpa 900 systems were packed and shipped into theater in Iraq. The two systems were accompanied by two Army officers, a combined team consisting of the materiel developer and the combat developer, who ensured a proper battle hand-off to the unit. While in theater, the team witnessed the first operational use of the Sherpa 900 system in support of Operation Enduring Freedom on 9 Aug 04. Both Sherpa 900s were dropped for a Marine forward operating base (FOB) called Camp Korean Village.

By late autumn 2004, 9 of 11 air drops with Sherpa 900 systems had been successful. Drop number six failed after the GPS did not receive satellite lock before exiting the aircraft. This resulted in an unguided flight to the ground. A problem on drop 11 caused the main canopy not to deploy. The cause of this canopy problem has not yet been determined, but the system has since been replaced. After completion of the required 10 extra-light air drops, DCD-QM anticipates that Multi-National Force-Iraq will request that Army G3 provide 18 more systems to complete its original Urgent Operational Needs Statement.

Modernizing Theater Distribution

Both the Army and the Air Force had been independently working their respective pieces of the JPADS program, but that came to a halt last August when the Air Staff directed incorporation of Air Force analysis and requirements into the Army documentation. On 28-29 Sep 04, DCD-QM hosted a Joint Requirements Working Group that brought all military services up to speed on both the JPADS program and documentation required the JPADS Extra Light and Light versions. Ultimately, the intent is to submit the 2,200-pound Extra Light requirement in 2d Quarter, FY05, followed by the 10,000-pound JPADS Light requirement as soon as its ACTD results are known.

The Air Force plays an important role on two fronts. First, the Air Force provides most JPADS aircraft delivery platforms, Secondly and most importantly, the Air Force brings its PADS capability that will provide near real-time wind information, further improving airdrop accuracy. The PADS today is a single, portable package of three major components on the PADS laptop computer. PADS will provide greater accuracy to ballistic high-altitude air drops and precision-guided, high-altitude air drop systems through algorithms and high- fidelity wind data.

Cargo air drop, and JPADS in particular, directly lead the way in supporting Modernization of Theater Distribution: one of the Army G4 (Logistics) four focus areas. Based upon the asymmetric battlefield, with long GLOCs and widely dispersed units, cargo air drop with a precision air drop capability is just what the combatant commander ordered. As one logistics operations officer with Multi-National Force-Iraq stated: "The Army is attempting to modernize its supply distribution process throughout Iraq and aerial delivery is certainly part of that. If we can use aerial deliver to keep Soldiers and Marines off the road, then that's a winner for everybody."

Chapter 5: Joint Asset Visibility Supporting the Warfighter

Section 1:
Joint Asset Visibility: Why So Hard?

LTC James C. Bates, USA (Ret.)

From a Department of Defense (DOD) logistics perspective, the attainment of asset visibility at the joint level will reduce the cost of resupply significantly and have a profound effect on warfighter readiness. In the last few years, the joint logistics community has made substantial advances in improving asset visibility, but it still has a long way to go before fully achieving such a capability. This is the first in a series of articles that will explore the complexities surrounding asset visibility and offer recommendations on how to improve it.

The term "joint asset visibility" as used here refers to supplies (expendable items) and equipment (nonexpendable items)—on order, in transit, in storage, or on hand—that are owned or destined for the military services, DOD agencies, or coalition partners. It does not refer to a software system. Although the DOD definition of asset visibility includes the tracking of personnel, this discussion will focus on supplies and equipment only.

Attaining Asset Visibility

Logisticians serving on the staffs of combatant commanders are keenly interested in knowing the aggregate status of supplies on hand, in transit, and on order for the military services and agencies that make up the joint force. This is particularly true for logisticians who have been designated to focus on a particular area of responsibility, such as a standing joint force headquarters, or those who have deployed as part of a joint task force.

Attaining asset visibility is incredibly difficult. It involves the entire DOD global supply chain (which dwarfs even Wal-Mart), binary code, the electromagnetic spectrum, worldwide telecommunications, local- and wide-area computer networks, and the integration and standardization of logistics data among the services and the domestic and international commercial sector. The architectural design of joint asset visibility should be viewed from what SOLE—the International Society of Logistics refers to as a "total system" perspective. The total system includes—

- The acquisition, supply, transportation, and financial communities.

- The wholesale level (the U.S. Transportation Command, Defense Information Systems Agency, Defense Logistics Agency (DLA), Army Materiel Command (AMC), Air Force Materiel Command, Naval Supply Systems Command, Marine Corps Materiel Command, General Services Administration, Army and Air Force Exchange Service, and Naval Exchange Service).

- The retail level (the warfighting units of the military services).

The following findings from Operation Iraqi Freedom and Operation Enduring Freedom after-action reviews illustrate the magnitude of the visibility problem—

Continue with efforts towards data standardization to improve interoperability between Service legacy information systems. Improve the joint compatibility of communication and coordination connectivity within the Theater Support Component Command (TSCC) and other logistic planning and execution entities in the theater. Align joint theater logistics standards and cross-Service arrangements to eliminate stovepipe support of common-user items. Supply chain processes, sustainment, transportation, and force protection are all areas that should be standardized across all Services and these standards used in joint training. A joint supply and management system for common items, most notably food, fuel, and munitions, should be developed. Cross-Service agreements should be enhanced to benefit from joint theater logistical opportunities.

ITV [in-transit visibility] continued to be a problem during Operation Iraqi Freedom (OIF), resulting in units having limited or no visibility of forward moving supplies and assets over extended lines of communication. As a result, cargo became frustrated, misdirected, delayed in delivery, improperly marked or lost. [*The Joint Lessons Learned Approach Package, Operation Iraqi Freedom (OIF), Major Combat Operations (MCO) Finding: Joint Theater Logistics (JTL),* 10 February 2005]

In OIF, the inconsistency in providing each of the required preconditions meant that enterprise integration and visibility did not exist. Limited system availability, poor data capture, unreliable communications, inaccessible data, and limited information fusion provided little more than "islands" of visibility in theater. This is best seen in the breakdown of the Army's Standard Army Retail Supply System/Standard Army Maintenance System (SARSS/SAMS) and the Marines Asset Tracking Logistics and Supply System/Supported Activity Standard Supply System (ATLAS/SASSY) logistics systems . . . the most commonly cited tracking and visibility tool is Excel and e-mail. [*Objective Assessment of Logistics in Iraq, DUSD (L&MR) and Joint Staff (JSJ4) Sponsored Assessment to Review the Effectiveness and efficiency of Selected Aspects of Logistics Operations During Operation Iraqi Freedom,* March 2004]

Key Aspects of the Asset Visibility Problem

These lessons learned demonstrate that the most difficult part of supply chain management is not the physical aspect of buying, receiving, storing, transporting, or issuing items; the hard part is obtaining, managing, and sharing the related information about the chain. In reality, moving the information is more complicated than moving the item itself. The following questions are keys to understanding joint asset visibility—

- What kind of information about an item do we need?

- Are the data elements standardized for computer processing?

- Where and how often do we want to capture the information?

- Whose job is it to capture the information?

- How do we capture the information?

- What logistics automated information systems are required?

- How can the information be shared electronically?

In an ideal world, any DOD-authorized individual would be able to access the Internet from a personal computer and obtain all of the pertinent information about an item. A wholesale buyer would be able to view information associated with the Material Inspection and Receiving Report (DD Form 250); a transportation coordinator would be able to view information found on the Government Bill of Lading (Standard Form 1103); and a clerk at a central receiving point would be able to view information contained on the Military Shipment Label (DD Form 1387).

As a rule, logisticians capture information about stored items daily and about items in transit whenever the items arrive at and depart from transshipment points or pass by predetermined information collection points. The term "transshipment point" refers to a place where cargo is stopped and reconfigured, such as an area where items are placed in a multipack container, onto an aluminum pallet, or into a 20- or 40-foot container. A transshipment point also refers to a location where the conveyance changes (for example, from one truck to another truck or from a truck to a plane, ship, or railcar). There are hundreds of different types of transshipment points. They can be domestic or international; they can be military or commercially run; they can be in developed areas or in austere environments; they can be under the watch of wholesale or strategic organizations, such as the U.S. Transportation Command, DLA, or the General Services Administration; or they can be managed by one of the services. They include depots, rail yards, airports and seaports, theater distribution centers, container handling areas, supply support activities, and central receiving and shipping points. They can be part of the Defense Transportation System or outside of it.

Since there is no such thing as a certified collector of asset visibility information, many different personnel are involved in capturing logistics data at the transshipment points and at more permanent storage locations. They can be Soldiers, Marines, Sailors, Airmen, or civilians. They can be employed by DOD or by commercial industry and can have supply, transportation, finance, or information technology backgrounds.

The expertise of the personnel who capture logistics data is geared toward using whatever logistics automated information system is employed where they work. Workers for the DLA use the Direct Support System or the Business System Modernization program; workers for AMC use enterprise resource planning (ERP) software developed by SAP International; workers at Air Force-managed airports use the Global Air Transportation Execution System (GATES) and Remote GATES; workers at Military Sealift Command or Military Surface Deployment and Distribution Command seaports use the Worldwide Port System and the Integrated Booking System. Army units use the Unit Level Logistics System, the Standard Army Retail Supply System, and the Standard Army Ammunition System. These are only a few of the hundreds of automated information systems that make up the feeder systems for wide-area networks, such as the Joint Operations Planning and Execution System (JOPES), the Global Transportation Network (GTN), the Defense Automatic Addressing System (DAAS), and the asset visibility application of the Global Combat Support System (GCSS).

Asset Visibility Technologies

Asset visibility-related information can be captured from the item's packaging (such as the DD Form 1387 or the accompanying packing list) by typing it into a computer. Of course, typing data is time-consuming and leads to numerous errors. An alternative is to use electronic data interchange (EDI) and automatic identification technology (AIT) that are being developed and used by the military and the commercial sector on a global scale. Examples include bar codes, smart cards, and radio frequency identification (RFID) devices. The promise of EDI and AIT

is mind-boggling since logistics information processing is a multibillion-dollar endeavor. This technology is constantly advancing as some of the best minds in the world work to exploit EDI and AIT possibilities.

The goal of EDI is to standardize the methods of electronically transmitting logistics data elements, while the goal of AIT is to reduce substantially the amount of human interaction required to capture asset visibility information. DOD must be able to adapt quickly, whenever appropriate, to the advancements of international and domestic logistics consortiums since it depends on the commercial sector as a source of supply and as a transporter of its supplies and equipment. These consortiums include the International Organization for Standardization; EPC global; the American National Standards Institute; the United Nations Electronic Data Interchange for Administration, Commerce, and Transport; GS1; and GS1 US.

Like DOD, these logistics consortiums have very lofty goals. For instance the goal of EPC global, which is spearheading the development of an electronic product code (EPC) for RFID, is to provide "immediate, automatic, and accurate identification of any item in the supply chain of any company, in any industry, anywhere in the world." However, the current reality is far removed from that goal. Passive RFID is in a relatively early stage of development, and many data standardization and software interoperability challenges must be overcome. Moreover, the advantages of RFID must be compared to its implementation costs and its inherent reliability. Just as important are information security factors, especially considering that, besides the typical computer attacks made by disgruntled computer "geeks," an enemy will employ its best information technology experts in attempts to disrupt DOD information systems.

Once logistics information is captured, it must be processed and stored on a computer. The type of hardware needed is becoming less and less of an issue since today's desktop computers have enormous capacities; besides, the bulk of the information is transmitted to a web-based network. However, many of our current asset visibility problems can be traced to the use of numerous automated information system software programs and applications. Most of these are legacy systems or simply revised versions of legacy systems. Some still depend on the 80-card column format developed in the 1950s. Others overly emphasize supply, transportation, acquisition, or financial information. Some automated information systems are designed to handle information on cargo moving by surface transportation, while others are designed to handle information on cargo moving by air. Some primarily capture Army information; others capture Air Force, Navy, Marine Corps, or DLA information. Some information is captured via the Secure Internet Protocol Router Network (SIPRNet), while other information is captured with the Unclassified but Sensitive Internet Protocol Router Network (NIPRNet). Some software systems are designed exclusively for the military, while others are used only by the commercial sector, which, when considered as a whole, has many more logistics-related software applications than DOD.

Once the information is captured by the software or application of a single computer device, it must be transmitted to a higher-level computer system or local-area network until the information makes its way to a web-enabled wide-area network such as JOPES, GTN, GCSS, or DAAS. If the transshipment point is in a developed area where telecommunications are available to transmit the data to the World Wide Web, then the only major decision to make is how often to send the data. Data could be sent in real-time, near-real-time (which has not been defined by DOD), or as an information batch. Real-time communication requires a constant telecommunications linkage—something that is not practical if expensive satellite communication is required. If the transshipment point is in an austere environment, establishing telecommunications with the World Wide Web becomes much more difficult and expensive.

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Like civilian industries, DOD uses the World Wide Web to access its overarching logistics management information systems. However, DOD does not have a single, all-inclusive, logistics network because a logistics-related Global Information Grid does not exist. Instead, DOD has many networks. Besides JOPES (which depicts deployment data), GTN (which depicts transportation data), and DAAS (which depicts supply data), DOD has many other high-level networks, each with its own server, software, and application system. The Army's tactical systems use the Standard Army Retail Supply System for classes I (subsistence), II (general supplies), III (petroleum, oils, and lubricants), IV (construction and barrier materials), VIII (medical supplies), and IX (repair parts) and the Standard Army Ammunition System for class V (ammunition). The wholesale element of the Army (represented by AMC) uses the Logistics Modernization Program—an ERP software system developed by SAP. DLA uses the Business System Modernization program. The Marine Corps uses SASSY and ATLAS.

These high-level networks are fed by numerous automated information systems, so, in many cases, the information available on one network is not available to other networks. Since the data elements are not standardized, logisticians must access several networks to obtain the information they need. Even if the data are available, it can take several hours for a trained logistician to retrieve a few pieces of desired information. Consequently, compiling meaningful logistics reports takes an inordinate amount of time.

Frankly, these overarching logistics management information systems are difficult to use and do not readily provide the fidelity required. Currently, many of these local-area network and wide-area network automated information systems are being subsumed by the Army, Air Force, Navy, or Marine Corps's versions of GCSS. These, in turn, will have to be interoperable with GCSS at the combatant command and joint task force (CC/JTF) level, which itself will have to be interoperable with the Global Command and Control System. Data standardization and interoperability issues associated with software applications and telecommunications are vexing problems because so many different logistics information systems are involved.

Determining What Information Is Needed

Let's revisit the first step to attaining joint asset visibility: What information do we need? The answer is that DOD's global supply-chain logistics managers need all kinds of information about an item. Moreover, although there are many common denominators, the various stakeholders, such as sellers, the acquisition community, the supply community, the transportation community, the financial community, and the chain of command of the buyers or owners of the items, require different types of information. The amount of data involved is startling.

Let's begin with the seller. The seller wants to know the purchaser and where and when to ship the item. The paper document used to capture this information is an invoice or a purchase agreement.

The acquisition community needs much of the same information. It also needs other information, such as the contract line item number, order number, acceptance point, discount terms, the name of the seller and whatever alphanumeric code is used to identify the seller, and the name of the individual accepting the item on behalf of the Government.

The supply community wants to know the name of the item; its identifying number, such as the national stock number (NSN), the contractor's part number, or the Army's line item number (LIN); and the unit of issue. The supply community also needs to know the required delivery date, the document number, the supply-related document identifier code, the quantity requested,

the routing identifier code, and if there are any advice codes (which requestors use to inform supply managers of special circumstances).

The transportation community wants to know the gross weight of an item and its height, width, and length. Transporters also want information on any hazardous material, the name of the shipper, transportation modes, the freight charges, the commodity type, the seal numbers, the standard point location code, the standard carrier alpha code, the transportation control number, the transportation-related document identifier code, the aircraft mission number or the voyage number, and the number of pieces.

The financial community wants to know the transportation account code, the mailing address to which the shipping charges should be sent, the type address code 3, and the bill of lading number

The chain of command awaiting the arrival of an item wants to know where the item is currently located and, more importantly, when it will arrive where it is needed. Logisticians would be interested in knowing if the item was under the control of a vendor, a DLA depot, a service depot, a U.S. or international airport or seaport, or some other transshipment point. They also might want to know if the item was being shipped in a multipack, pallet, or container and the mode of transportation.

The list below shows the wide scope of information required from a total-system supply-chain perspective. It is by no means all inclusive. Some of the data pertain to containers used to protect or transport the items.

Pertinent Logistics Information About an Item of Equipment of Supply Being Moved or in Storage		
Air commodity code	Item description (if nomenclature has not been assigned)	Special handling code
Bill of lading number	Latitude of transshipment point	Self-life code
Commercial and government entity (CAGE) code	Longitude of transshipment point	Shipped from
Cargo category code (JOPES)	Length	Shipped from date
Commodity code	Mark for address	Standard carrier alpha code
Condition code	Military preservations method and date of unit preservation	Standard port location code
Container number	National stock number (NSN)	Supplementary address
Contract number	Nomenclature	Time asset arrived (per transshipment point)
Contractor	Number of pieces	Time asset departed (per transshipment point)
Consignee	Part number	Transportation account code
Consignor	Order number	Transportation control number
Cube	Origin	Transportation priority
Date asset arrived (per transshipment point)	Pallet identification number	Type address code
Date asset departed (per transshipment point)	Piece number	Ultimate consignee (mark of COCAAC)
Destination	Port of debarkation	Unit identification code
Discount terms	Port of embarkation	Unit line number
Document identifier code	Postage data (TCMD)	Unit of issue
DUNS number	Project code	Unit price
Expedite handling code (999)	Purchase order number	Voyage document number
Gross weight	Quantity	Vessel name
Height	Required delivery date	Weight (expressed in pounds)
Invoice number	Routing identifier code	Width of item
	Serial number	**This list is not all-inclusive.**

Item Identification Codes

Some of the information shown on the list at right is unique to the military, while other information is similar to that used in the commercial sector. For instance, the military normally uses the NSN and the commercial and Government entity (CAGE) code, while the commercial sector refers to a stock keeping unit (SKU) and Data Universal Numbering System (DUNS). Some of the information describing the same type of data is expressed in many different ways. From a total system perspective, this is one of the major reasons that DOD data cannot be readily processed within the myriad wholesale, retail, service, and agency automated information systems. As a result, the wide-area networks that manage DOD logistics information are not as accurate, comprehensive, timely, or useful as they could be. To make a simple analogy, consider the word "pharmacy." If we were to search a database dictionary looking for "pharmacy" by starting with the letter "f" instead of the letter "p," it would take a long time to uncover information about this word—if ever.

DOD services and agencies do not use the same basic naming and numbering conventions. This means that the pertinent logistics information is not visible to or exploitable by the many military global supply-chain stakeholders. For instance, the vehicle that most military personnel call a "humvee" has no single, agreed-on name. The Federal Logistics Information System, DOD's most authoritative source, calls this item a "truck, utility." Others call it a "hummer" or a high-mobility, multipurpose, wheeled vehicle (HMMWV). It is also known as an M998A1; an armored 4x4 crew-cab pickup; a TRK UTIL M998A1; or a truck utility: cargo/troop carrier, 1½-ton, 4x4, M998. Similar to the futility of finding information about the word "pharmacy" by looking under the letter "f," the same futility would occur if logisticians conducting research on a "truck, utility" tried to access the data using the first letter of the abbreviation HMMWV.

Besides using naming conventions, the military also uses codes to identify items, which facilitates the electronic processing of information. As with item names, no single code (numeric, alphabetic, or alphanumeric) universally identifies a specific type of equipment or item of supply. The primary DOD supply code is the NSN, which is comprised of 13 numeric digits. However, the Army also uses the LIN—an alphanumeric code composed of one letter and five numerals, and the end item code—a three-character alphabetic code. DLA's Defense Logistics Information Service (DLIS) database depicts both the NSN and the LIN, but it also includes and promotes the use of an item name code—a five-digit numeric code. The Marine Corps uses a six-digit alpha-numeric code called the item designator number. A HMMWV could also be identified by using a CAGE part number.

This lack of standardization is a huge, costly problem since effective data processing is highly dependent on exactness. For instance, because The Army Authorization Document System uses LINs instead of NSNs, this incredibly robust, web-enabled database is not compatible with those databases that rely on NSNs. Although it is possible to obtain information by converting LINs to NSNs, this process is time-consuming (especially if a large amount of data is involved) and significantly reduces the utility of automation.

The military also has several means of identifying ammunition and fuel. Along with the NSN, other codes for ammunition include the DOD identification code and the DOD ammunition code. Fuel can be identified by the NSN, a U.S. fuel code, or a NATO fuel code. For instance, aviation turbine fuel has an NSN of 9130–01–031–5816, a U.S. fuel code of JP8, and a NATO fuel code of F–34.

DOD uniquely identifies location in many ways. The commercial sector also uses several methods to identify location. Since 85 percent of military cargo is moved by the commercial sector, DOD must assimilate the methods of the commercial sector within its information processing environments.

A physical location can be identified by street address, city, state, and zip code (or some type of similar convention for international addresses). A virtual location can be identified using an email address or Internet protocol address. Similar to items of supply or equipment, an address is frequently identified by both a name and by a code (which can be numeric, alphabetic, or alphanumeric). For instance, JOPES uses a geographic name (called "GEO name") and a four-character alphabetic designator called the "geographic location code." The Defense Transportation Regulation (DTR), however, does not use the JOPES coding convention. The DTR and the GTN use three-character air terminal identifier codes and water port identifier codes to designate port locations. Some commercial activities identify airports using an alphabetic, four-character code called "ICAO," developed by the International Civil Aviation Organization. Other commercial activities use an alphabetic, three-character code called "IATA," developed by the International Air Transport Association. (See the article, "Joint Force Logistics: Keeping Track of Forces on the Move," published in the January–February 2006 issue of Army Logistician.)

The National Motor Freight Association uses standard point location codes, DLA uses type address codes, and the Defense Automatic Address Service Center uses both routing identifier codes (RICs) and DOD automatic address codes (DODAACs) to identify location. Ship-to addresses, mark-for addresses, supplementary addresses, plain language message identifier addresses, Army or fleet post offices, billing addresses, and in-the-clear addresses all describe location— physical or virtual.

As you can imagine, neither the military services, DOD agencies, nor the domestic and international commercial sectors have agreed on standardized conventions to identify location. However, with the emergence of the Global Positioning System and computerized maps, the concept of identifying location by latitude and longitude is gaining acceptance. Using a code that is based on the geometry of the Earth has tremendous advantage.

Unit Identification

DOD units and activities also are identified by written or spoken names and codes. JOPES and the Global Status of Resources and Training System (GSORTS) are the primary automated information systems that depict information identifying military units and DOD activities. GSORTS uses both a long unit name, which can be a maximum of 55 characters, and an abbreviated unit name, which can be a maximum of 30 characters. However, DOD has no centralized approving authority for service and agency unit names.

Because of the limits on the number of characters that can be used to describe military units and other DOD and Government agencies, many of the names are not readily comprehended by those unfamiliar with unit and agency types. For example, logisticians who are Sailors or Airmen or who work at the wholesale level may not be able to understand the abbreviated name of the Army's 11th Armored Calvary Regiment: 0011 AR RGT (AR CAV RGT). Some might wonder if the "AR" stands for Army, Army Reserve, Air, or Armored. The logistics databases within DOD use neither GSORTS abbreviated names nor GSORTS long names to identify units. Different names for the same unit have evolved as the result of the many legacy automated information systems.

Likewise, different alphanumeric codes are used within DOD to identify units; the unit identification code (UIC) is the primary one. Units that have the same generic structure are also coded using the unit type code (UTC). The Army also uses a modification table of organization and equipment (MTOE) code to identify units. Another Army code used to identify units is the standard requirements code (SRC), which is based on the authorized level of organization code and the MTOE code. The SRC and the JOPES UTC capture similar data, although the structures of the two codes are entirely different. The SRC is a 12-character alphanumeric code, while the UTC is a 5-character alphanumeric code. Unfortunately, it is difficult to integrate the separate databases that use one or the other. Other codes that identify units or agencies include the six-character alphanumeric DODAAC, the three-character RIC, and the CAGE, which identifies non-DOD units. The standard carrier alphabetic code is used to identify commercial transportation companies.

DOD has many middleware software programs intended to reduce interoperability and standardization problems. Although middleware can bridge information-processing gaps, relying on one software system or application to perform a specific function is much better than depending on software or application systems that are linked to other systems through middleware. Determining the cause of a problem is much easier when no middleware is required because only a single hardware, software, and telecommunications system is in operation. When middleware is involved, the diagnosis of a problem is magnified threefold since problems can be caused by the software, the hardware, or the telecommunications of any one of the three systems involved. As a rule, the less middleware involved, the better the electronic processing of information will be.

Communicating With Commercial Systems

Just as the physical movement of items alternates between the Defense Transportation System and the commercial transportation sector, the information pertaining to the movement of these items must be processed alternately by both commercial and DOD automated information systems. Not only is data standardization and interoperability a problem within DOD, it is also a problem within the commercial sector. This problem is magnified even further when information is processed by several commercial and DOD automated information systems. Unless dealing specifically with the military, the commercial sector does not recognize military coding conventions such as the UIC, DODAAC, RIC, and CAGE.

The commercial sector understands the need to standardize data and integrate computer processes. National and international organizations have been established to work toward improving EDI with the goal of reducing human manpower and error during information processing. The long-term EDI objective is to avoid the manual reentering of logistics information into subsequent systems once it has been digitized within an initial automated information system. The American National Standards Institute has chartered the Accredited Standards Committee X12 to develop uniform standards for EDI. (See "Transforming Joint Logistics Information Management" in the January–February 2005 issue of Army Logistician.)

The EDI products of standardized digitization are called "transaction sets." Air shipment information, vessel content data, freight receipts, invoices, purchase orders, and order status inquiries are a few examples of transaction sets. The EDI standards are globally disseminated by the United Nations Electronic Data Interchange for Administration, Commerce, and Transport. As a result, DOD must keep pace not only with its own transformational logistics initiatives but also with the revolutionary initiatives being developed in the commercial sector since DOD is a subset (albeit a very large subset) of global commerce. Consequently, DOD data elements should

replicate standardized commercial data elements whenever possible and redundant data elements should be gradually removed from DOD databases. For instance, the SRC could be subsumed by the UTC; the DODAAC could be subsumed within the UIC; and the CAGE code could be subsumed within DUNS.

Here are some examples of the need for data standardization. The different automated information systems depict the day of the year and the time of day in various formats. January 31, 2006, could be displayed as follows: 31Jan06, 1/31/06, 1/31/2006, and 0316. Different countries use different methods of depicting dates. Time of day can be depicted in local time, or it can be based on Greenwich Mean Time. It can be expressed using a 24-hour clock or with the use of a.m. and p.m. Moreover, with a global supply chain, the differences between the use of the metric system of measurement and the English system of measurement can lead to confusion. Barrels, miles, and pounds may have to be converted to cubic meters, kilometers, and kilograms. Fahrenheit may have to be converted to Celsius. Simply said, the more standardized the data, the fewer mistakes will be made.

Developing and implementing a standardized logistics management information system that achieves total asset visibility is an enormous undertaking. It will require the integration of numerous data elements from both the commercial sector and within the services and DOD agencies. Consequently, the more logisticians who understand the complexities involved, the better they will be able to overcome the systemic problems associated with EDI and AIT. The next article in this series on joint asset visibility will discuss where and how information for joint asset visibility can be captured.

Section 2:
Joint Asset Visibility: Why So Hard? Capturing Information

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In the second of his articles on joint asset visibility, the author discusses the processes and systems used for capturing data for asset visibility.

Department of Defense (DOD) stakeholders are interested in obtaining a lot of information about items in transit or in storage. Information about items in storage is usually reported whenever on- hand balances change, such as when additional items are received or issued. However, this information is usually updated on a daily basis as it is passed electronically through the supply chain—from the unit level to battalion, brigade, division, theater, and onwards to the strategic-level—using wide-area networks such as the Joint Operations Planning and Execution System (JOPES), the Global Transportation Network (GTN), or the Defense Automatic Addressing System (DAAS).

In an ideal world, the worldwide DOD item balances would be updated automatically any time ownership or location of an item changed. In reality, however, this is not the case; the limitations of telecommunications and the time needed for some computers to process information prevent real-time displays.

For example, consider high-mobility multipurpose wheeled vehicle (HMMWV) tires. Let's say that, on a particular day, the various units and DOD agencies have a worldwide total of 100,000 tires stored or in transit at 5,000 different sites. How could logisticians keep track of the on-hand balances of all of the HMMWV tires over time as tires were purchased, issued, condemned, and transferred at the various locations? After all, not all of these sites would be connected to the World Wide Web. (For instance, a large portion of a deployed ground force may be powered by generators or may have no electrical power source at all. Without access to an electrical grid, it is much more difficult to connect to the Web.) For units not connected to the Web, logistics information is still passed along the supply chain echelons, but this is done in batch mode, not real time. A unit might have to deliver a disc to the automated information system of its supply support activity (SSA), or perhaps the SSA would have to send its asset visibility information via satellite to the automated information system at theater level. Depending on the unit's location, the method of transmission, and the extent of information to be passed, the use of direct links to satellites can be an expensive, manpower-intensive proposition. Moreover, some legacy automated information systems need time to process account balances, putting all other computer processes on hold while preparing to transmit data to a higher or lower echelon. Instead of being passed and processed in real-time, the information is passed and processed in a batch. A batch of information may be passed at various time intervals, such as hourly, twice a day, four times a day, daily, weekly, or monthly. However, for the most part, stakeholders within the DOD global supply chain are looking for daily asset visibility reports for supplies and equipment in storage or on hand at the unit level. For instance, most DOD logistics managers would be more than satisfied with daily on-hand availability updates by location of HMMWV tires (or other item).

Although DOD supply chain stakeholders can accept in-storage information that is updated daily, they want updates about items in-transit on a more frequent basis. Ideally, stakeholders want to know when an item in transit arrives and departs a transshipment point.

Items traverse a wide variety of transshipment points "from factory to foxhole." As soon as DOD purchases an item from a manufacturer or a retailer, it begins accounting for that item. Information about the item must be captured, preferably electronically, and passed from one automated information system to another until it reaches a wide-area network, accessible by all DOD logisticians. However, different transshipment points capture different types of logistics information. Depots capture wholesale information. Airports managed by the Air Force capture air transport information. Strategic deployment and distribution centers or seaports run by the Navy capture information pertaining to surface delivery. Managers at commercially run transshipment points capture logistics information that is pertinent to their particular needs. Personnel at transshipment points must capture not only information about the item being shipped but also information about the type of conveyance being used to transport the item to the next transshipment point.

The Data Capture Challenge

Unfortunately, many transshipment points do not have the manpower, computing power, or telecommunications equipment needed to capture all of the pertinent logistics information. This is especially true when items in transit are substantially reconfigured.

Let's look at a hypothetical scenario. To support forces deployed throughout Iraq, Defense Logistics Agency (DLA) personnel stationed at the Defense Distribution Depot Susquehanna, Pennsylvania, load 4,000 different items (with 4,000 different national stock numbers [NSNs] and 4,000 different document numbers) into one 40-foot container. The automated information system at this sophisticated transshipment point electronically captures the NSN and document number for each item within the container. This information is then passed to the wide-area networks, such as JOPES, DAAS, and GTN.

Next, the container is sent to a military or commercial port in the continental United States, where the supply and transportation data are again easily captured. This is not that difficult because the contents of the 40-foot container remain the same; only the container's location has changed. While en route to Iraq, however, the vessel transporting the container turns out to be too big to transit the Suez Canal. The vessel's draft also is too deep to access the overseas port of debarkation. As a result, the contents of the 40-foot container have to be off-loaded at an intermediary port at the entrance of the Suez Canal and loaded into two 20-foot containers. In this case, the previous content integrity of the 40-foot container is now gone. At this new transshipment point (the intermediary port), the automated information system now must update the container information for two containers, each with 2,000 items. Whatever data processing codes were used to identify the contents of the 40-foot container must be updated to identify the contents of the two 20-foot containers. Will this commercial overseas port be able to capture this information and then pass it on to the wide-area networks? The answer depends on the port.

Actually, this problem is even more complex than it first appears. The contents of the one 40-foot container could be spread out into 5, 10, or 20 different 20-foot containers, each containing previously loaded items in addition to the contents transferred from the 40-foot container. Similarly, the contents of each of the resultant 20-foot containers could be further broken down at a subsequent transshipment point into pallets and loaded onto aircraft, railcars, and trucks.

Will transshipment points (especially the commercial ones with scant DOD representation) have the capability to capture the appropriate logistics information into automated information systems and then transmit this information to the respective wide-area networks? The answer is probably not.

Consider how much time it would take for one person to scan the two-dimensional (2D) barcodes of military shipment labels or, worse yet, manually enter content-level data into automated information systems. Even with the most rudimentary information, such as nomenclature, document number, NSN, and transportation control number data, errors naturally occur whenever human entry is required. Some studies indicate that, for every 85 keystrokes, 3 errors are made unbeknownst to the operator. And with coded information like an NSN, if the input contains a single incorrect character, the accurate code (in this case the NSN) cannot be processed by the automated information system. Capturing barcoded information is easier and less error prone, but it is still very time-consuming; it also requires the appropriate barcode readers and complementary automated information system. Radio frequency identification (RFID) offers promise, but it is not the sole solution.

> **Although DOD supply chain stakeholders can accept in-storage information that is updated daily, they want updates about items in-transit on a more frequent basis.**

Let's consider a simpler scenario. What if the Susquehanna Depot completely stuffed a 20-foot container with a single item: concertina wire (NSN 5660–00–921–5516). In this case, there would be only one customer and only one document number. The concertina wire, destined for an SSA in Iraq, would remain intact inside a container throughout its shipment from the depot all the way to the SSA somewhere north of Baghdad. In this scenario, the automated information system at DLA could easily capture the pertinent information about the container's contents and associate it with the identification number of the container. This information then could be readily passed to a wide-area network, where it could be viewed by interested logisticians worldwide. All they would need to know would be the document number or the container number. Shareholders would be able to track some of the movement of the container as it made its way to Iraq as long as the various transshipment points being transited had a means of capturing the container number as it arrived and departed and a means of passing this information to a wide-area network.

So Much Data!

However, let's take a look at a more realistic scenario. Think of how much logistics data would have to be captured and passed pertaining to a vessel carrying the equivalent of 6,000 different 20-foot containers. If each container had 2,000 different items within it, 12,000,000 different items would be on board the vessel (6,000 * 2,000). How much information would we need to capture about each item? If we only needed the document number and NSN, then we would need to capture 24,000,000 different data elements (6,000 * 2,000 * 2). But if we wanted to track each item's document number, NSN, nomenclature, unit of issue, condition code, supplementary address, required delivery date, weight, cube, and project code, then we would need to capture 120,000,000 different data elements. We also might want to track the identification numbers of all the multipacks inside the containers so that we could associate all of the NSNs within with their specific multipack identification numbers.

If each 20-foot container were to have 50 multipacks within it, then there would be 240,000 multipacks (6,000 containers * 2,000 items per container ÷ 50 items per multipack) onboard the

vessel. If these multipacks were atop pallets, with each pallet holding 6 multipacks, then there would be 40,000 different pallets (240,000 multipacks ÷ 6). Each pallet should have a unique identifying number, and each pallet number should be correlated to the identifying numbers of the six multipacks on the pallet. Associating a specific item's document number with the identifying number of its multipack, with the identifying number of its pallet, with the identifying number of its container, and with the identifying number of the vessel can be extremely complicated. After all, in the scenario just described, 1 ship is carrying 6,000 containers, 40,000 pallets, 240,000 multipacks, and 12,000,000 different items. The amount of data that would have to be loaded into automated information systems is mind-boggling. It would take a very, very long time to capture all of these data by hand or using barcode readers, especially if it were done while the ship was being loaded. (See the article, "Containerizing the Joint Force," published in the March–April 2005 issue of Army Logistician.)

The challenge in the scenario described above is created by the enormous amount of data. The scenario assumed that the port of debarkation had sophisticated data-capture equipment and telecommunications. Let's take a look at a different problem. What would happen if the transshipment point were located in a very austere environment, like a desert, where enablers such as electricity, computers, and telecommunications were not even remotely available? What if the transshipment point were simply a spot in the sand where the form of conveyance changes, say from a commercial truck to a military truck? How can the information about the items that were transferred be captured within automated information systems? Under our current procedures, the answer is that the information may not be captured.

Whose Job Is It To Capture the Information?

A major problem in capturing information pertaining to asset visibility (in-transit visibility in particular) is that DOD has no designated military occupational specialty or civilian equivalent specifically trained to do so. Since so many different types of transshipment points are run by so many different types of organizations, no one has been trained on how to capture the information about supplies in transit using both joint military procedures and commercial practices. No standardized automated information systems or telecommunications systems are available to capture the information and pass it to the wide-area networks (which themselves are not standardized). Many transshipment points, such as overseas seaports and railheads, may have no DOD presence at all.

Capturing Information at Transshipment Points

Just as not every transshipment point has a designated specialist, no set method has been established for capturing the required asset visibility information. Several methods of capturing data should be available to help ensure reliability. The most basic method is for clerks to capture information by manually transferring data from the shipment documents or by jotting down the logistics data shown on the item's packaging. However, if a clerk were simply to file the information in a filing cabinet, it would not be visible to logisticians with access to the wide-area networks. It would be much better if a clerk were to enter the pertinent logistics information into an automated information system. It would be better still if he were to capture the logistics information using electronic data interchange (EDI) and automatic information technology (AIT).

Since both EDI and AIT rely on computer processing, let's take a look at some of the rudiments of this incredibly complex field. The ability of computers and telecommunications devices to digitize information has been truly revolutionary and has been, and still is, one of the

cornerstones of logistics transformation. But what do we mean when we say information has been digitized? In the most basic sense, all computerized information can be subcomposed into what are called "bits." The word bit began as an abbreviation for the phrase "binary digit." The root of binary is "bi" which connotes two of something. In computer terms, binary code means either 1 or 0; it also connotes the concept of something being on or off. Just as a light switch can be turned on or off, a silicone chip can be turned on or off. Binary code, then, is a stream of some combination of the digits 0 or 1 and is used as the basis for computer processing.

The American Standard Code for Information Interchange (ASCII), a widely accepted method of encoding characters based on the English language, uses binary values. For example, the binary value of the ASCII letter M is 00 1101 and the number 2 is 11 0001. In computer processing, such binary values can depict all the letters of the alphabet (both uppercase and lowercase), all numbers, and many special characters. Binary numbers are used to compose hexadecimal numbers (with a base of 16 binary digits), which are used extensively in RFID devices.

The text and numbers included within almost every electronic document can be subcomposed into a series of 0s and 1s. As an analogy, think how a person can navigate anywhere in the world by making a series of decisions based on only two choices: go left or go right. In our digitized world, 8 bits make 1 byte, which usually represents one alphabetic character (like A, B, or C), one special character (like &, *, or ?), or two numeric digits. A kilobyte is a measure of 1,024 bytes; a megabyte is a measure of 1,048,576 bytes; and a gigabyte is a measure of 1,073,741,824 bytes. A standard $50 thumb drive can store one gigabyte.

AIT Devices

The linear barcode is the most basic of the several different types of AIT used to store a wide variety of data. The linear barcode can store 17 to 20 alphanumeric characters. It is typically used to store one key data element, such as an NSN, a document number, or a transportation control number. If all three of these numbers are on the packaging of a container, a clerk has to scan all three numbers separately to retrieve the digital information the barcodes portray. The newer and more sophisticated 2D barcodes have a greater capacity that the linear barcode; a 2D barcode can portray about 1,850 different characters and is more reliable than a linear barcode because it has several layers of data repetition as part of its design.

A clerk at a transshipment point or a storage facility can either scan the barcodes by sliding them across a fixed scanner or use a portable scanner called a portable data collection device to scan items at various locations within a warehouse or storage yard. Regardless of whether the barcode scanner is portable or fixed, it must be linked to a computer to process the digital information, although the linkages (particularly with the portable data collection device) may be wireless. The laser technology associated with barcode readers must be able to see the barcode. In other words, the barcode must be within the barcode reader's line of sight. Humans must be involved in lining up an item's barcode with the barcode reader. This means that only one item's barcode can be scanned at a time, and a human must be present during the scanning process. This time-consuming, human involvement is not necessary for RFID.

Optical memory cards (OMCs) are another form of AIT. OMCs are the size of credit cards and use the same type of technology as CD–ROM products. Data are downloaded onto the cards in sequential order; once loaded onto the card, the data cannot be overwritten. In other words, portions of data cannot be erased (although the entire contents can be erased so that the card can be reused as if it were new). Additional data are loaded onto the card until its capacity is reached. These small cards can store over 2 megabytes of data. They are rugged, inexpensive to produce,

and unaffected by environmental conditions such as moisture and heat. Smart cards (also called common access cards, or CACs) are similar to OMCs. Like OMCs, smart cards are the size of credit cards. While OMCs are used to capture information about supplies and equipment, smart cards are used to capture information about people. They currently have a data storage capacity between 16 and 32 kilobytes.

The contact memory button is another type of AIT, which is currently used by the Department of the Navy to store information about a major end item's maintenance history. A memory button is a battery-free, read/write, identification device designed for use on components and equipment in harsh environments.

Understanding RFID

RFID is the most sophisticated type of AIT. To understand the complexities associated with RFID, it is best to introduce the rudiments of the science that makes it possible. Let's start with a brief discussion of the electromagnetic spectrum.

According to the website of the Goddard Space Flight Center of the National Aeronautics and Space Administration (NASA)—

Electromagnetic radiation can be described in terms of a stream of photons, which are massless particles each traveling in a wave-like pattern and moving at the speed of light. Each photon contains a certain amount (or bundle) of energy, and all electromagnetic radiation consists of these photons. The only difference between the various types of electromagnetic radiation is the amount of energy found in the photons.

The spectrum of electromagnetic energy, from low energy to high energy, includes amplitude modulation (AM) radio waves, shortwave radio waves, very high frequency (VHF) radio waves (used by television), frequency modulation (FM) radio waves, ultra high frequency (UHF) radio waves, microwaves, infrared light, visible light (light that humans can see), ultraviolet light, x rays, and gamma rays. The electromagnetic spectrum can be expressed in three different ways: wavelength, frequency, and energy. AM radio (at the lower end of the spectrum) has long wavelengths (measured in meters—the distance between the crest of one radio wave and the next), low frequency (measured in cycles per second), and low energy (measured in electron volts). In comparison, gamma rays are at the highest end of the electromagnetic spectrum. They have short wavelengths, high frequency, and high energy.

Because so much technology is based on the electromagnetic spectrum, governments (including our own) have established guidelines to regulate portions of it. For instance, the Federal Communications Commission grants broadcast licenses to radio and television stations. Without some type of regulation, two radio stations in the same area, one a hard rock music station and the other a classical music station, might broadcast their different musical genres at the same exact frequency. Regardless of musical taste, the result would be unpleasant to hear.

RFID is based on the technology associated with the electromagnetic spectrum. Measured in hertz (1 hertz equals 1 cycle per second, where a cycle is the passing of one complete wave of energy), most RFID devices operate within a radio frequency of 124 kilohertz (124,000 cycles per second) to 2.45 gigahertz (2.45 billion cycles per second). RFID devices use the energy of radio waves as a basis for digitizing logistics information. The lower frequencies are less affected by metal and moisture than the higher frequencies, but the latter can be read at greater ranges.

Radio wave readers (interrogators) emit radio waves to radio tags (transponders). The tags include both a mini-antennae and a computer chip; the latter contains digitized information about the items attached to the tags. The three types of RFID tags are active, passive, and semi passive.

An active RFID tag contains batteries. These batteries enable the tags to transmit information to a reader. A passive tag does not contain batteries or any other type of internal power source. It receives its energy from the reader, which emits its energy via radio frequency (RF) waves to the passive tag, which then uses the microchip's antennae to convert this energy into electricity to transmit the information stored in its chip through its antennae back to the reader. A semipassive tag makes use of an internal power source that monitors environmental conditions and runs the chip's microcircuitry. In order to conserve energy, many semipassive tags stay dormant until power is received from an interrogator. However, like passive tags they require RF energy transferred from the reader/interrogator in order to power a tag response.

Unlike barcodes, OMCs, or smart cards, RFID does not require human involvement in the scanning process. In fact, RFID tags do not have to be scanned via a line-of-sight process as do the other forms of AIT. Similar to audible sound (which is itself radio waves), RFID radio waves reverberate over a large area and can be captured by a reader even when the source of the radio wave is not within a line of sight. This means that the reader/interrogator does not have to be facing an item to sense it is nearby, as long as the item is located somewhere within the range of the interrogator. Moreover, the information transmitted by radio wave frequency can be captured quickly by the interrogator and the computer linked to it. The logistics information about thousands of different items can be captured within seconds, without human involvement.

Although several different types of active tags are used by DOD, the typical one, when compared to passive tags, is larger in physical size, costs more, stores more data, and transmits further. Active tags are about the size of a can of beer, cost about $70 each, contain 128 kilobytes of data, and can transmit information a radial distance (omnidirectional) of 300 feet if unobstructed. Passive tags are much smaller (about the size of a postage stamp), cost as little as $0.25, store as little as a few bits of data, and must be read within 3 to 10 feet.

Active RFID Tags

The most sophisticated active tags can transmit data directly to satellites, which then relay information to appropriate wide-area networks. Because of the high cost of these tags and the expense associated with using satellite telecommunications, these types of tags are reserved for tracking time-sensitive items, such as critical ammunition or perishable items. However, these tags are being used more often, and associated costs are expected to drop.

In Iraq and Kuwait, logisticians are using satellites to track the locations of specially equipped containers that have been outfitted with "AXTracker" global positioning system (GPS) tracking devices, which are manufactured by a high-tech corporation called Axonn. These self-contained devices, which are 9 inches by 6.25 inches by 1 inch, can be attached to containers easily. They send signals to low Earth-orbiting satellites, which relay a container's current GPS location and other information such as ambient temperature, humidity, and whether or not the container is stationary or moving. The satellites then transmit the information to ground-based computer gateways that pass the information to web portals. The AXTracker has specially designed batteries that can last from 3 to 18 years, depending on how often information is relayed to the satellites.

Active tags—the type typically placed on railcars, major end items, 20-foot containers, and 463L pallets—have their own unique tag identification numbers. When active tags are placed on 20-foot containers, they normally do not contain very much data on the items within the container. However, AIT systems and wide-area networks are being designed to correlate an active RFID tag number with the physical location of the tag, the time the tag was read, and the contents of the container. This is currently accomplished at DLA container and consolidation points and DOD-run seaports in the United States.

> **A major problem in capturing information pertaining to asset visibility (in-transit visibility in particular) is that DOD has no designated military occupational specialty or civilian equivalent specifically trained to do so.**

Active RFID readers normally are positioned at transshipment points, at preselected checkpoints along a designated route, and at end unit locations. Unlike passive tags, some of the data stored on an active tag can be changed using radio wave frequency transmission. Usually, however, a person loads the appropriate information onto a tag at a computer docking station. The loading of digital information onto a tag is called "writing" or "burning."

As with most technology, active RFID tags are not without certain problems. Their batteries go dead; the more frequently data are exchanged between the tag and the reader, the sooner this happens. For example, if an active tag on a 20-foot container being hauled by a tractor passes by a fixed interrogator at 20 miles per hour, the tag will be read only once. However, if the tractor-trailer happens to be parked for several days near that same interrogator, the tag will be read numerous times and its battery life will be significantly reduced. Furthermore, because of the omnidirectional nature of the RF transmissions, the same active tag may be read by two separate interrogators at the same time.

Passive RFID Tags

Unlike active tags, passive tags are being designed to be an integral part of nearly every piece of equipment and of all but the smallest or most inexpensive supplies. As technology improves, the cost per tag is expected to drop below $0.05. Active tags are normally placed on items at transshipment points. However, passive tags are assimilated into items at the point of manufacture. Passive RFID tags in transit or in storage can be read by readers at a rate of more than 1,000 tags per second.

Passive tags do not contain very much logistics information; they are similar to that of a license plate in that they contain only a few alphanumeric characters. A passive tag, like a license plate, is used as the key for obtaining additional information. For example, a police officer who stops a car for speeding can simply call police headquarters and report the alphanumeric characters of the license plate. Headquarters then would use the license plate number to access its database and uncover all types of information pertaining to the car and owner, such as vehicle registration data and arrest records.

RFID Shortcomings

RFID technology, particularly passive technology, is still relatively new and developing. Many of the active tags and the interrogators designed to read them are not interoperable with the passive tags and interrogators. It is almost as if there are two separate systems. Moreover, a comprehensive architecture for the AIT systems and the wide-area networks associated with

RFID has not been designed on a global scale yet, although a great deal of progress has been made in areas where U.S. forces have an established presence.

A major weakness of RFID is that the technology can be interrupted by the enemy. Interrogators placed along delivery routes are easily seen and sabotaged, and their very emplacement indicates the location of a main supply route. Furthermore, it is unlikely that rapidly advancing forces will have the time and wherewithal to establish interrogators along the route of troop advance. Data-read capability is also an issue. The placement and positioning of the tags and the interrogators makes a difference as to whether or not the data are successfully transmitted.

Active tags are more susceptible to enemy interference than passive tags for several reasons. First, since active tags transmit data over longer distances, the enemy has a better opportunity to corrupt or impede the transmissions. Second, active tags contain more information for the enemy to corrupt than do passive tags. Lastly, the enemy could actually change the data on active tags that have read/write capability since most tags currently in use are not encrypted.

In some DOD experiments, passive tags placed on the inside of multicontent pallets were not picked up by the interrogator. This could have occurred because certain radio frequencies do not penetrate easily through liquids or humid conditions. For instance, paper products have high moisture content, so their passive tags do not always enable the capture of complete and accurate information. Similarly, the RF waves associated with passive tags do not readily pass through dense objects or metals. Data-read also depends on the quantity of tags being read by a single reader, the speed of the tags passing by a reader, and the distance between the tag and the reader. The more tags being read, the greater the speed of the tags in motion, and the greater the distance the tag is from the reader, the less reliable the reads will be. Probably because passive RFID technology is in its nascent stage, some studies indicate that the low-cost tags can be damaged during production, which frequently happens when microchips are attached to the mini-antennas. Tags can also be damaged when logistics data are written to them.

Additional issues are associated with RFID technology. Tags that use a frequency of 433 megahertz can interfere with military radar. The electromagnetic energy of RF can adversely affect people, ordnance, and fuel. RF transmissions at 2.45 gigahertz excite water molecules; not coincidentally, this frequency is used by microwave ovens to heat food.

Like the United States, foreign governments regulate frequencies within their airspace. This means that DOD must obtain permission from foreign governments for deployed U.S. forces to use certain portions of the electromagnetic spectrum. Currently, no international agreements stipulate electromagnetic frequencies for RFID. The spectrum being used for RFID ranges from 860 to 960 UHF within the United States, Europe, and Japan. However, there is a growing global acceptance of designating a few frequencies exclusively for RFID use.

Regardless of the method in which it is captured, logistics information pertaining to asset visibility must be accurate and complete. Commanders and logisticians must firmly believe that the information they retrieve about items in storage or in transit is reliable. After all, supply and equipment readiness is an integral part of combat power.

Section 3:
Joint Asset Visibility: Why So Hard?
Commercial Sector Information Technology Advancements

LTC James C. Bates, USA (Ret.)

In the third article of his asset visibility series, the author discusses how commercial sector advancements in information technology are being used to help DOD meet its asset visibility needs.

Radio frequency identification (RFID) is having a transformational effect on the entire global supply chain. Some of the most intellectually talented people in the world are working on using RFID to capture logistics data. This is not surprising, considering the effect that the reduction in manpower and the improvement in the amount and availability of logistics information resulting from the adoption of RFID technology will have on the world economy. The cost savings to the Department of Defense (DOD) alone have been estimated to be as high as $1.781 billion.

Just as DOD benefits from the integrating influence of the Joint Staff and the U.S. Joint Forces Command, the commercial sector has many national and international organizations that standardize data, techniques, and procedures in order to promote domestic and global supply chain standardization and interoperability. Many of these organizations influence DOD directly or indirectly. Some of the more important are the International Organization for Standardization (ISO); the American National Standards Institute (ANSI); the ANSI Accredited Standards Committee (ASC); the United Nations/Electronic Data Interchange for Administration, Commerce, and Transport (UN/EDIFACT); GS1; GS1 US; the National Motor Freight Association; and Electronic Product Code-Global (EPCglobal). These organizations have tremendous influence in the conduct of global commerce and directly affect DOD.

Electronic Data Interchange

One of the major long-term goals of both the commercial sector and DOD is to significantly reduce the amount of human involvement needed to input logistics data to automated information systems that, in turn, digitize and electronically process the data. Currently, at almost every transshipment point, Soldiers, Sailors, Airmen, Marines, and civilians manually enter information into automated information systems. Most of this information, however, has already been digitized and processed by other automated information systems. The burgeoning implementation of electronic data interchange (EDI), which passes logistics information electronically (not only within corporations but also among them), is yet another truly transformational endeavor.

The ANSI ASC X12 Committee promulgates EDI domestically, while UN/EDIFACT does so internationally. Reducing the amount of human involvement in capturing logistics data not only improves data reliability by reducing human error; it tremendously speeds up the process and saves billions of dollars a year.

ISO Developments

ISO develops worldwide industrial and commercial standards. It is a consortium of national-level standards organizations, with representatives from major commercial industries and sectors. While it is chartered as a nongovernmental organization, it has a great deal of influence on governments since many of its standards become law and are included in treaties. In an effort to develop standards for information technology (IT), ISO teamed with the International Electrotechnical Commission (IEC) to form the first ISO/IEC joint technical committee. This committee is working toward developing and promoting the Interoperability of IT systems, tools, automatic identification, and other data capture techniques.

GS1 and GS1 US

GS1 US, formerly called the Uniform Code Council (UCC), oversees the domestic use of the universal product code (UPC), or bar code. GS1 US joined the GS1 in 2002. According to its website, GS1 is a voluntary standards organization charged with the management of the EAN [European Article Numbering]/UCC System and the Global Standard Management Process. The EAN/UCC System standardizes bar codes, EDI transaction sets, extensible markup language (XML) schemas and other supply chain solutions for more efficient business practices. By administering the assignment of company prefixes and coordinating the accompanying standards, GS1 maintains the most robust item identification system in the world.

GS1 and GS1 US have developed the global trade item number (GTIN), which is used as the basis for all UPC bar codes. The GTIN (comprising only numbers—letters and characters are excluded) uniquely identifies commercial items sold, delivered, and stored throughout the world. The number also includes a method of identifying level of packaging to include unit, case, and pallet. Currently, a GTIN can be 8, 12, 13, or 14 digits long.

In addition to the GTIN, the GS1 and GS1 US have developed the global location number (GLN), which is meant to provide a worldwide, standardized way of identifying locations. The GLN is a 13-digit number. According to the GS1 US website, 196 different location coding methods are recognized by the ANSI ASC X12 and 212 different location coding methods are recognized by the UN/EDIFACT. The international and national standardization organizations are working to reduce this number.

GS1 and GS1 US also have developed a serial shipping container code (SSCC) to identify logistics-related shipping containers, a global individual asset identifier (GIAI), and a global returnable asset identifier (GRAI). The GTIN, GLN, SSCC, GIAI, and GRAI numbers have been specifically designed to promote electronic commerce and interoperable logistics information flow. The GS1 US website describes the situation as follows—

Managing the physical flow of product with the electronic flow of business data is a major challenge in today's intensely competitive environment. The same time, attention, and detail that goes into designing and producing a quality product must also be evident in the transmission of that product's business data through the supply chain. A system built with standardized processes and a common business language is needed to monitor and manage the movement of product and information through every component along the supply chain.

Electronic Product Code

EPCglobal is a joint venture between GS1 and GS1 US. This organization oversees the EPC. Just as the bar code has reduced the time and manpower needed to capture data on an item's

identification, the EPC is doing likewise with RFID technology. The EPC is a license plate-type number that uniquely identifies items of equipment and supplies. It is designed to assimilate the different item identification numbering schemes of both the commercial and government sectors.

Each EPC number contains header data (assigned 8 bits), a manager number (assigned 28 bits), an object class (24 bits) and a serial number (36 bits). Information contained in a passive EPCglobal RFID tag consists solely of the EPC, although additional fields are sometimes needed to encode and decode information from a multitude of numbering systems to make them readable by humans.

Just as DOD uses automated information systems, local area networks, and wide area networks to correlate pertinent logistics information to a national stock number, transportation control number, or document number, the EPCglobal Network uses the EPC as its basis for data correlation. According to the EPCglobal website, "The EPCglobal Network is a set of technologies that enable immediate, automatic identification and sharing of information on items in the supply chain … enabling true visibility." The EPC is one of the five elements of the network; the others include the identification system (RFID tags and RFID readers), the object name service (ONS), Savant (a software technology), and the physical markup language (PML).

Object Name Service

ONS converts alphabetic names into numeric Internet protocol addresses. The RFID Journal describes ONS as—

. . . an automated networking service similar to the domain name service (DNS) that points computers to sites on the World Wide Web. When an interrogator reads an RFID tag, the electronic product code is passed to middleware, which, in turn, goes to an ONS on a local network or the Internet to find where information on the product is stored. The middleware retrieves the file (after proper authentication) and the information about the product in the file can be forwarded to a company's inventory or supply chain applications.

The RFID-associated middleware described above is Savant. The RFID Journal describes Savant systems as "distributed software systems developed … to act as the central nervous system of the Electronic Product Code Network. A Savant takes data from an RFID reader, does some filtering, handles product lookups and sends the information on to enterprise applications or databases."

Physical Markup Language

The last of the five elements of the EPCglobal Network is the PML. Just as there is hypertext markup language (HTML) for use with the Internet, there is now a PML for use with the EPCglobal Network. It establishes data for physical objects. The RFID Journal explains it this way: The EPC identifies an individual product, but all the useful information about that product is written in PML, a new standard computer code. PML is based on the widely accepted XML.

Because it is meant to be a universal standard for describing all physical objects, processes, and environments, PML will be broad and will cover all industries. It will provide a common method for describing physical objects and will be broadly hierarchical. So, for instance, a can of Coke might be described as a "carbonated beverage," which would fall under the subcategory "soft drink," which would fall under the broader category "food." Not all classifications are so simple, so to ensure that PML has wide acceptance, EPCglobal is relying on work already done by standards bodies, such as the International Bureau of Weights and Measures and the National Institute of Standards and Technology in the United States.

The amount of data transmitted over the EPCglobal Network is expected to grow at a phenomenal rate. VeriSign, an information technology firm that provides digital security and network infrastructure services, manages both the domain name service (which currently handles about 17 billion messages a day) and the ONS. Some estimates suggest that, within the next decade, the ONS network will transmit nearly 4 quadrillion messages a day.

Logistics Network Diversity

As the preceding paragraphs point out, the amount of daily computer processing associated with attaining visibility of items in transit and in storage is enormous and will only get larger. RFID tags alone will not solve this complex problem. The really hard part is matching the scant "license plate" data contained on a passive RFID tag with robust, interoperable automated information systems. These systems, in turn, must provide information that can be processed and effectively organized within a single wide area network, viewable by authorized stakeholders around the world.

What makes this so hard? Hundreds of different automated information systems make up the DOD global supply chain. Many of these systems were designed decades ago, and most of these systems were not meant to provide information to the wide area networks that are now accessible through the Internet. Moreover, almost none of these systems process information in a method that is compatible and interoperable with a "total system" perspective. Instead, they were developed by the disparate communities within DOD, such as Army wholesale supply, strategic air transportation, strategic surface transportation, local truck transportation, Army retail supply, Navy retail supply for aviation, Navy retail supply for vessels, Marine Corps retail supply, Air Force retail supply, and strategic deployment.

Because the systems have been designed and fielded to solve parochial information requirements with little thought to the DOD global supply chain, they are a prime example of suboptimization, in which overemphasis of a portion of the supply chain enables it to perform better at the expense of the larger, more important total system. This bottom-up approach to information architecture (where the services and the agencies design their own information systems) degrades interoperability and inhibits data integration across the DOD global supply chain. In fact, DOD has not one but several supply chains.

As simply another player in worldwide commerce, DOD must be able to adapt quickly to the ongoing transformational, logistics-related IT developments that are gaining acceptance in the civilian sector. This is a challenge for DOD since there is no unified direction regarding IT assimilation.

Instead of one all-encompassing logistics-related wide area network, DOD has several. Logistics data are captured on both a classified wide area network and an unclassified wide area network, thereby inhibiting the exchange of information among the systems. Functionally, we have "families of systems" that feed families of systems. It is no surprise that logistics data are not standardized, integrated, or interoperable among these hundreds of locally designed automated information systems. The following sidebar lists a few of the DOD logistics management information systems; it is by no means an all-inclusive list.

DOD Logistics Information Systems

Air Force Equipment Management System (AFEMS)	Global Transportation Network (GTN)
Asset Tracking and Logistics Automated Support System (ATLASS)	Integrated Booking System (IBS)
	Joint Force Requirements Generator (JFRG II)
Automated Air Load Planning System (AALPS)	Joint Operations Planning and Execution System (JOPES)
Automated Manifest System (AMS)	Naval Construction Force Management Information System (NCFMIS)
Business System Modernization (BSM)	
Cargo Movement Operation System (CMOS)	MAGTF (Marine Air Ground Task Force) Deployment Support System (MDSS II)
Combat Ammunition System (CAS)	Marine Corps Ammunition and Accounting Reporting System (MAARS–II)
Computerized Movement Planning and Status System (COMPASS)	
	Marine Corps Stock Control System (MCSCS)
Conventional Ammunition Integrated Management System (CAIMS)	Standard Army Ammunition System (SAAS)
Cargo Routing Information Management (CRIM)	Standard Army Retail Supply System (SARSS)
Defense Automatic Addressing System/Logistics Information Processing (DAAS/LIPS)	Standard Base Supply System (SBSS)
	Standard Automated Materiel Management System (SAMMS)
Defense Blood Standard System (DBSS)	Standard Property Book System-Redesigned (SPBS–R)
Defense Fuels Automated Management System (DFAMS)	Supported Activity Standard Supply System (SASSY)
Defense Transportation Recording and Control System (DTRACS)	Theater Army Medical Management Information System (TAMMIS)
Defense Transportation Tracking System (DTTS)	Transportation Coordinators Automated Information Management System II (TC–AIMS II)
Department of Defense Activity Address File (DODAAF)	
Distribution Standard System (DSS)	Transportation Coordinator Automated Command and Control Information System (TCACCIS)
Defense Reutilization and Marketing System (DRMS/DAISY)	Unit Level Logistics System-Ground (ULLS–G)
Fleet Inventory Transaction System (FITS)	Worldwide Ammunition Reporting System (WARS)
Force Inventory Management Analysis Reporting System (FIMARS)	Worldwide Port System (WPS)
Global Air Transportation Execution System (GATES)	

If the information captured and processed by an automated information system is to be passed on to the DOD global supply chain, there must be a means of transmitting the logistics information to a wide area network for global supply chain integration. The Air Force normally deploys to fixed facilities with links to an electric grid, and the Navy deploys with a full complement of sophisticated satellite telecommunications gear. However, land forces typically deploy over very large geographical areas that often are not connected to an electrical grid and have no connection to the Internet, a wide area network, or sometimes even a local area network. Similarly, many temporary transshipment points and the transshipment points in austere environments are not connected to information networks.

Reporting Asset Status

The guidance on which level of organization should provide reports regarding asset receipt, issue, and storage information appears to be conflicting. In the past, DOD required visibility of items only as far forward as the supply support activities (direct support units). However, as IT improves, users of the DOD supply chain will desire visibility of items received, issued, and stored at unit level. Let's take a look at why this is so important.

Let's say that a supply support activity (SSA) supports a brigade-sized force of 3,000, which is composed of 25 individual units (120 soldiers per unit). When they are on the move or deployed to austere environments, these units have difficulty transmitting their logistics information to the SSA, which also provides a local area network and has links to a theater-level local area network that, in turn, has links to the wide area networks.

In fast-paced tactical operations, it is very difficult to achieve full IT connectivity between the units and the SSAs that support them. Because of this, logisticians in the DOD global supply chain often are not able to view the receipts, issues, and on-hand balances of the units. A unit may receive a critical repair part, but, if this information is not passed to the information networks, interested stakeholders will not know about it. Furthermore, the global supply chain will not have inventory data on the combat loads of the units. Combat loads are expendable items that are meant to sustain units until replenishment arrives from a supply source. They usually are measured in days of supply.

This is a serious flaw since, on an aggregate level, the number of items stored within combat loads is quite large and can represent the bulk of items in storage within an operational area. For instance, if an SSA stocked 25 high-mobility multipurpose wheeled vehicle (HMMWV) tires, but each of the 25 units supported by the SSA stocked 4 HMMWV tires, the aggregate number of tires stored at the unit level would be 4 times as large as the number stocked at the direct support level. Similarly, logisticians with visibility of unit combat loads of operational rations, packaged petroleum, barrier materials, small arms ammunition, and common repair parts would be in a much better position to ensure readiness, especially if cross-leveling were required.

Considering that our deployed land forces must now operate in noncontiguous, distributed environments with supply lines subject to perpetual interruption and interdiction, it makes sense to track on-hand balances at all inventory points, to include the unit level. With advancements in IT, it is much easier to move logistics data than it is for service members to move supplies continually. On today's and tomorrow's battlefields, the best source of resupply, especially on a temporary basis, may be a unit nearby. If this can be done, not only within a single service but among all of the services, coalition forces, and interagency partners, the incidence of stock outs (required items at zero balance) will be significantly reduced. The exchange of just one repair part might allow an M1A1 battle tank to resume full combat operations, for example. Improving readiness at the unit level clearly demonstrates the importance of the ongoing commercial and military efforts to standardize information, enhance EDI, and exploit automatic information technology. Although these efforts have already made a significant improvement to distribution, even greater improvements are on the horizon.

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